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EARTH CASE FILE COPY RESOURCES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

ISSUE 11

OCTOBER 1976

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PREVIOUS EARTH RESOURCE BIBLIOGRAPHIES

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EARTH RESOURCES

A Continuing Bibliography With Indexes Issue 11

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between July 1976 and September 1976 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA)*



Scientific and Technical Information Office
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
OCTOBER 1976
Washington, D.C.

INTRODUCTION

The technical literature described in this continuing bibliography may be helpful to researchers in numerous disciplines such as agriculture and forestry, geography and cartography, geology and mining, oceanography and fishing, environmental control, and many others. Until recently it was impossible for anyone to examine more than a minute fraction of the earth's surface continuously. Now vast areas can be observed synoptically, and changes noted in both the earth's lands and waters, by sensing instrumentation on orbiting spacecraft or on aircraft.

This literature survey lists 714 reports, articles, and other documents announced between July and September 1976 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*.

The coverage includes documents related to the identification and evaluation by means of sensors in spacecraft and aircraft of vegetation, minerals, and other natural resources, and the techniques and potentialities of surveying and keeping up-to-date inventories of such riches. It encompasses studies of such natural phenomena as earthquakes, volcanoes, ocean currents, and magnetic fields; and such cultural phenomena as cities, transportation networks, and irrigation systems. Descriptions of the components and use of remote sensing and geophysical instrumentation, their subsystems, observational procedures, signature and analyses and interpretive techniques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography will also be included. The bibliography does not contain citations to documents dealing mainly with satellites or satellite equipment used in navigation or communication systems, nor with instrumentation not used aboard aerospace vehicles.

The selected items are grouped in nine categories. These are listed in the Table of Contents with notes regarding the scope of each category. These categories were especially chosen for this publication, and differ from those found in *STAR* and *IAA*.

Each entry consists of a standard bibliographic citation accompanied by an abstract. The citations and abstracts are reproduced exactly as they appeared originally in *STAR*, or *IAA*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the variation in citation appearance.

Under each of the nine categories, the entries are presented in one of two groups that appear in the following order:

- IAA* entries identified by accession number series A 76-10,000 in ascending accession number order.

- STAR* entries identified by accession number series N 76-10,000 in ascending accession number order;

After the abstract section, there are five indexes:

- subject, personal author, corporate source, contract number and report/accession number.

AVAILABILITY OF CITED PUBLICATIONS

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All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc. (AIAA), as follows: Paper copies are available at \$5.00 per document up to a maximum of 20 pages. The charge for each additional page is 25 cents. Microfiche⁽¹⁾ are available at the rate of \$1.50 per microfiche for documents identified by the # symbol following the accession number. A number of publications, because of their special characteristics, are available only for reference in the AIAA Technical Information Service Library. Minimum airmail postage to foreign countries is \$1.00. Please refer to the accession number, e.g., (A76-10543), when requesting publications.

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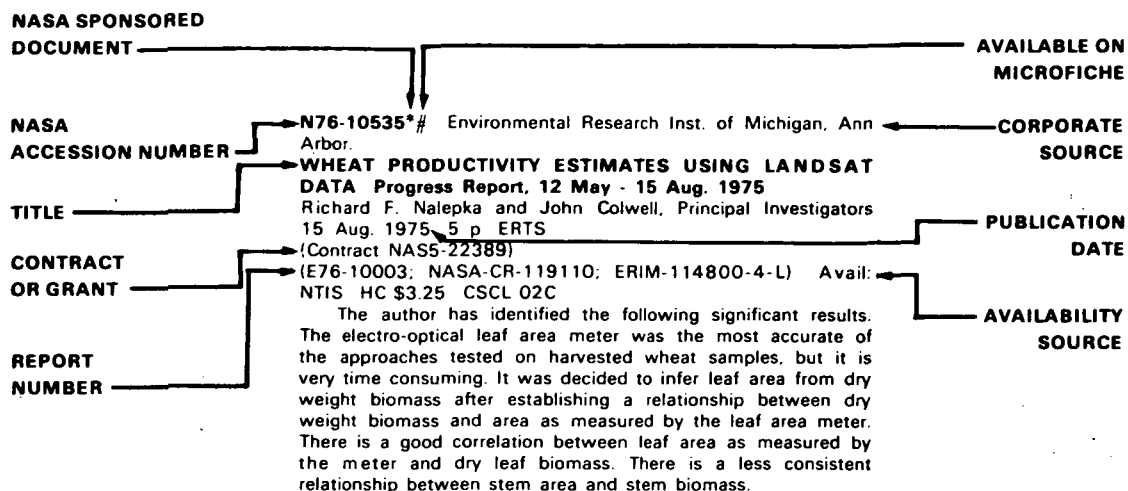
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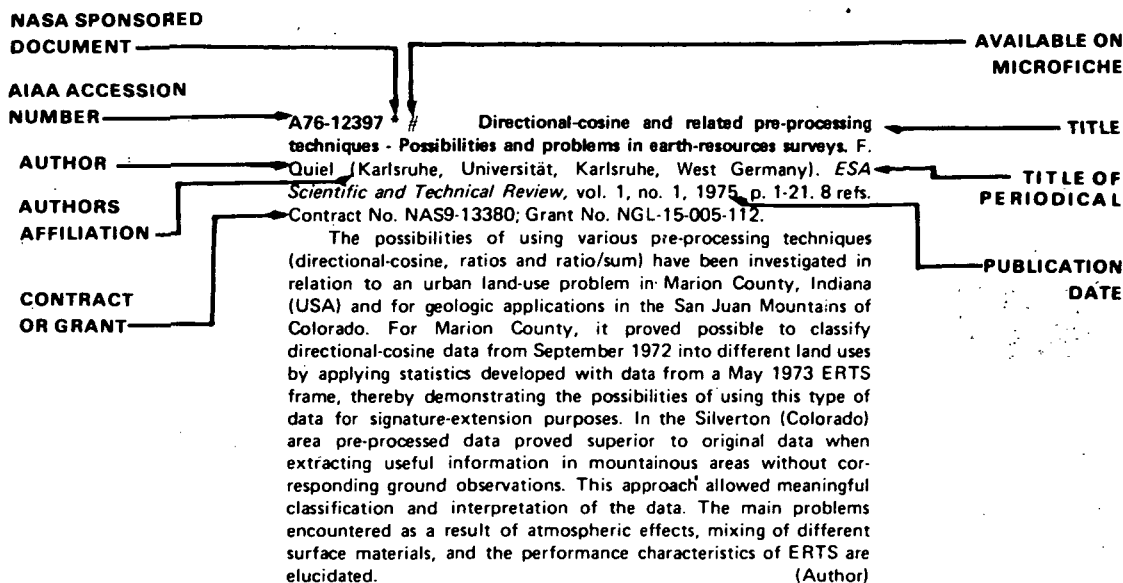
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EARTH RESOURCES

A Continuing Bibliography (Issue 11)

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01

AGRICULTURE AND FORESTRY

Include crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns.

A76-30726 Radar return from a continuous vegetation canopy. T. F. Bush and F. T. Ulaby (University of Kansas Center for Research, Inc., Lawrence, Kan.). *IEEE Transactions on Antennas and Propagation*, vol. AP-24, May 1976, p. 269-276. 11 refs.

The radar backscatter coefficient (RBSC) of alfalfa was investigated as a function of both radar parameters and the physical characteristics of the alfalfa canopy. Measurements were acquired with an 8-18 GHz FM-CW mobile radar over an angular range of 0 to 70 deg as measured from nadir. The experimental data indicate that the excursions of RBSC at nadir cover a range of nearly 18 dB during one complete growing cycle. An empirical model for RBSC was developed, which accounts for its variability in terms of soil moisture, plant moisture, and plant height. (Author)

A76-31451 # Identification of fire-blight attack on trees with the aid of aerial photography (Erkennung von Feuerbrand-Befall an Bäumen mit Hilfe der Luftbildphotographie). E. Krauth and H. Schreiber (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Satellitenelektronik, Oberpfaffenhofen, West Germany). In: *Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports*. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 393-403. In German.

The paper describes a study evaluating the capability of color and color infrared aerial photographs for yielding sufficient information for recognizing forest areas attacked by fire-blight. A color densitometer was used to determine the density or transparency of the red, green, and blue color portions of a given image point on the film. By forming the color transparency differences for all pairs of spectral regions it was possible to obtain characteristic features. The differences were graphically represented by the cluster method. The combinations of spectral regions whose transparency differences afforded the best criteria for classifying diseased plants were determined. P.T.H.

A76-31452 # The importance of remote sensing techniques for inventories of forests and vegetation stocks (Die Bedeutung von Fernerkundungsverfahren für Inventuren von Wäldern und Vegetationsbeständen). H. Kenneweg (Göttingen, Universität, Göttingen, West Germany). In: *Symposium on Earth Survey, Porz-Wahn, West Germany, Apr. 7-11, 1975, Reports*. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 405-418. 16 refs. In German.

The paper discusses general considerations for planning a vegetation inventory program. Various inventory levels are discerned and discussed with respect to questions of technical feasibility. Special consideration is given to possible inventory projects in central Europe. P.T.H.

A76-32173 # The application of mathematical optimization to forestry problems (Anwendung der mathematischen Optimierung auf Probleme der Forstwirtschaft). G. Gierth (Dresden, Technische Universität, Dresden, East Germany). *Wissenschaftliche Zeitschrift*, vol. 24, no. 6, 1975, p. 1463-1467. 9 refs. In German.

Investigations were conducted with the objective to enhance forest productivity and to make the best possible use of the available land resources. A description is given of mathematical models which represent practical problem situations of forest management. Attention is given to the application of fertilizer by means of aircraft, the optimal distribution of available funds, and problems related to the provision of wood of different characteristics in quantities which will result in maximum economic benefits. Approaches for solving the problems with the aid of the methods of discrete optimization are discussed. G.R.

A76-32428 * California resource inventory via satellite sensing. R. N. Colwell (California, University, Berkeley, Calif.). In: *International Symposium on Space Technology and Science, 11th, Tokyo, Japan, June 30-July 4, 1975, Proceedings*.

Tokyo, AGNE Publishing, Inc., 1975, p. 929-934. 6 refs. NASA-supported research.

There is a rapidly increasing need for wise management of such earth resources as agricultural crops, timber, forage, water, minerals; soils, fish, wildlife and oceanographic and atmospheric resources. An important first step leading to such management is that of obtaining accurate inventories of these resources, quickly, economically, and at suitably frequent intervals. Remote sensing from such manned satellites as Skylab, and from such unmanned satellites as those in the Landsat series, is proving to be of great value in the making of these inventories. Numerous examples are given of the uses made of satellite sensing as an aid to resource inventory in California. Also included is a consideration of the optimum uses that can be made of Skylab-EREP type data in conjunction with lower and higher resolution remote sensing data as acquired by Landsat-type vehicles and by aircraft, respectively. (Author)

A76-33123 * Detection of saline soils with Skylab multispectral scanner data. A. J. Richardson, A. H. Gerbermann, H. W. Gausman, and J. A. Cuellar (U.S. Department of Agriculture, Weslaco, Tex.). *Photogrammetric Engineering and Remote Sensing*, vol. 42, May 1976, p. 679-684. 10 refs. NASA Order T-4105-B.

A76-33124 * Utilization of satellite data for inventorying prairie ponds and lakes. E. A. Work, Jr. (Michigan, Environmental Research Institute, Ann Arbor, Mich.) and D. S. Gilmer (U.S. Fish and Wildlife Service, Jamestown, N. Dak.). *Photogrammetric Engineering and Remote Sensing*, vol. 42, May 1976, p. 685-694. 12 refs. NASA Order S-70243AG-4.

ERTS-1 data were used in mapping open surface water features in the glaciated prairies. Emphasis was placed on the recognition of these features based upon water's uniquely low radiance in a single near-infrared waveband. On the basis of these results, thematic maps and statistics relating to open surface water were obtained. In a related effort, the added information content of multiple spectral wavebands was used for discriminating surface water at a level of detail finer than the virtual resolution of the data. The basic theory of this technique and some preliminary results are described. (Aut: A)

A76-33180 # In situ multispectral studies: Comparison with multispectral sensing - Applications in agronomy (Etudes multispectrales 'in situ': Comparaison avec enregistrements multispectraux - Des applications en agronomie). C. Girard (Institut National Agronomique Paris-Grignon, Paris, France). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 39-49. In French.

The possibility of distinguishing between different crops at various points in the growth cycle by means of ground reflectance measurements and by multispectral sensing from an aircraft was investigated. The reflectance of corn, winter wheat, potatoes, kidney beans, lucerne, and mangel-wurzel was measured by a spectroradiometer. With the exception of young corn, the reflectance of which was indistinguishable from bare soil, these crops were easily distinguished by comparison of their reflectance at 550, 675, 900, and 1000 nm. These crops can also be readily distinguished by multispectral sensing by aircraft at an altitude of 1200 m. Good separation is possible by comparison of results in the 650-700, 800-890, and 920-1100 nm bands. Results obtained for corn and kidney beans using the two methods are qualitatively identical; and ground results for these crops can be used to select the spectral bands in which they can be distinguished by multispectral sensing. When the foliage cover is less than 15%, results obtained by both methods are indistinguishable from those for bare soil. C.K.D.

A76-33182 # Mapping soil and associated resources in Northeastern California using ERTS-1 and supporting aircraft data. S. D. De Gloria and D. M. Carneggie (California, University, Berkeley, Calif.). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 65-74.

A76-33184 # Multispectral remote sensing application in rangeland capability evaluation for grazing. M. K. Nosseir (Instituto de Pesquisas Espaciais, São José dos Campos, São Paulo, Brazil). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 89-99. 5 refs.

A76-33185 # The reconnaissance of forest species using aerial photographs taken outside of the growth season (Reconnaissance des essences forestières sur photographies aériennes prises hors saison de végétation). P. Schram (Service de l'Aménagement des Bois, Luxembourg). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 101-112. In French.

Aerial photographs on a scale of 1:10,000 taken in the early spring before the appearance of foliage were analyzed with the help of a stereoscope to obtain information on the population and distribution of various tree species in a forest area. It was found that the absence of foliage facilitated the identification of species and the classification of the forest composition as predominantly mature trees, brushwood, or mature trees plus undergrowth and scrub. The distinguishing characteristics of the more common tree species, including oak, beech, hornbeam, poplar, birch, Norway spruce, Douglas fir, black pine, and Japanese and European larch, are discussed in detail. C.K.D.

A76-33186 # An attempted forest classification at the regional level using ERTS-1 MSS imagery. U. Nielsen and J. M. Wightman (Canadian Forestry Service, Forest Management Institute, Ottawa, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 113-123.

The possibility of using ERTS-1 imagery for constructing

regional maps is examined. A forest classification map of the Province of Ontario is presented as an illustrative example. It is shown that the use of ERTS-1 imagery for this purpose is more limited than has been expected, although it permitted mapping of the boundaries of some of the major forest types. A major factor of this limitation is the inconsistency of the imagery, inasmuch as the differences in quality are highly pronounced among black-and-white and color scenes. These qualitative differences are primarily due to a combination of variables pertaining to image reproduction and date of data acquisition. These problems do not appear when use is made of much smaller-scale images such as those obtained daily by NOAA-2. S.D.

A76-33188 # Automated waterfowl census. D. Bajzak (Newfoundland, Memorial University, St. John's, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 137-145. Research supported by the National Research Council of Canada.

Results are presented for research work in the field of automated census of game birds by means of aerial photography and microdensitometry. The discussion covers the procedure of automatic interpretation and count of game birds in three steps: aerial photography, digitization of images, and pattern recognition. Two camera systems are simultaneously used in the aerial photographic missions, one camera having a short-focal-length lens to provide pictures covering a large area and the other camera having a long-focal-length lens to provide an enlarged strip of the large area. The small-scale aerial photographs are used for the total count of birds, while the large-scale photos give indication of the distribution and percentage of various species and various classes of a species. Images of birds are digitized using a scanning microdensitometer. The digitized image field of an aerial photograph is read into an IBM 370-155 computer and stored on a disk. It is shown that remote sensing with pattern recognition is an effective tool in waterfowl census. S.D.

A76-33192 # Forestry aerial photo-interpretation and resource inventories in India. K. P. Tiwari (Indian Photo-Interpretation Institute, Dehra Dun, India). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 177-189. 15 refs.

A76-33193 # Preliminary results of the interpretation of ERTS-1 imagery for a soil survey of the Mérida region, Spain. F. W. Hilwig, D. Goosen (International Institute for Aerial Survey and Earth Sciences, Delft, Netherlands), and D. Katsieris. In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 191-214. 11 refs.

A76-33194 # Optimum ratio of photo-field plots for aerial volume and aerial volume growth regression construction. D. A. Stellingwerf (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 215-231.

The optimum proportion of field/photo plots for a fixed cost ratio of field and photo plots is calculated for spruce in forest stands covering 3000 hectares in Austria. Two cases are considered: optimum proportion for constructing a volume table, and optimum proportion for constructing the gross mean volume growth table. Linear regression equations are taken for both the volume table and the volume growth table. A combination of field plots and photo fields is consistently less expensive than field plots alone. Additional photography costs (including those incurred for management purposes) are also taken into account. R.D.V.

A76-33195 # Assessment of volume characteristics of tropical rain forests on large scale aerial photographs. P. J. D. Versteegh (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 233-244. 5 refs.

A76-33201 # Soil erosion toposequences on aerial photographs. E. Bergsma (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 317-328. 24 refs.

Soil erosion features may occur in a regular sequence of types and intensities along the hillslopes in a certain area. The study of aerial photographs of medium to large scales, taken in the right season, can show the areas where an erosion toposequence occurs. The presence or absence, of an erosion toposequence and the kind of sequence depend on the runoff conditions. This has implications for soil conservation and land classification. (Author)

A76-33204 # Forest fire spread and energy output determined from low altitude infrared imagery. B. D. Lawson (Canadian Forestry Service, Victoria, British Columbia, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 363-378.

A76-33205 # Landslide analysis and susceptibility mapping. T. T. Alfoldi (Department of Energy, Mines, and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 379-388. 11 refs.

The eastern portion of Ontario is extensively covered by a glacio/lacustrine deposit, popularly called 'Leda' clay. This clay has the particular feature of being extremely sensitive to disturbance. A critical loss of strength results from remoulding, which phenomenon is manifest throughout the region as landslides. Airphoto interpretation proves to be the only practical and economical means of identifying existing landslides over a large area. By examining the nature of such landslides in both theory and ground observation, and subsequently developing an airphoto recognition pattern, it has been possible to do an inventory of landslides over eastern Ontario using existing aerial photography. An attempt is also made to construct a list of those parameters which are recordable on remotely sensed imagery and indicate susceptibility to slope failure. (Author)

A76-33209 # Interpretation of vegetation damage, extensively managed lands. P. A. Murtha (British Columbia, University, Vancouver, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 429-437. 23 refs.

A review of published literature on the use of remote sensing and interpretation techniques in monitoring damage to forests resulting from insect activity, disease, air pollution, herbicides, and other agents is presented. Special emphasis is placed on the use of color-infrared photographs to monitor insect defoliation of evergreen trees. ERTS-1 infrared imagery on ultrasmall scales (1:137,000) has been used with some success to delineate areas of insect infestation and SO₂ damage. The development of standard guidelines to assess the extent and impact of damage, and the elaboration of test techniques to define differences in the color perception of individual human interpreters remain major obstacles to the widespread use of remote sensing techniques in this application. C.K.D.

A76-33210 # Forest insect damage and cover types from high-altitude color-IR photographs and ERTS-1 imagery. J. Beaubien and L. Jobin (Canadian Forestry Service, Laurentian Forest Research Centre, Sainte-Foy, Quebec, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 449-454. 7 refs.

A76-33211 # Recognition of fire-blight diseases by means of aerial photography. E. Krauth and H. Schreiber (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Oberraden, West Germany). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 455-465.

Fire-blight is a bacteriological disease which destroys some types of brushwood and fruit-trees. This paper investigates the possibility of early recognition of the disease by means of aerial photography using colorfilm and color infrared film. It is found that color densitometric measurements on photographs are suitable for classification of sick and healthy leaves by revealing regularities in the density differences between different spectral bands. For these measurements color infrared film is more effective than color film. With the cluster method differences can be graphically presented along with combinations of spectral bands, whose density differences yield the best criteria for classification of infected plants. Misinterpretation of aerial photographs is possible due to similar regularities on images of other healthy types of vegetation. S.D.

A76-33212 # Spectral reflectance of desert vegetation and remote sensing. N. G. Kharin (Turkmen Academy of Sciences, Desert Institute, Ashkhabad, Turkmen SSR). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 493-500. 5 refs.

Spectral reflectance of 30 desert plants growing in various sites was studied. Spectral reflectance coefficients were measured in the spectral band of 400-900 nm. Spectral reflectance at any wavelength can be estimated using 6 selected points (500, 550, 600, 660, 755, 845 nm). Phenological charts of indicator-plants are given, they show the proper season of aerial photography. (Author)

A76-33223 # Coastal microrelief and associated vegetation recognized on air photos of Melville and Vasey Hamilton Islands. I. Resch. In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 621-627. 12 refs.

A brief history of beach development is outlined. The distribution pattern and morphology of ice-pushed ridges were recorded (during summer, 1973) on Melville and Vasey Hamilton Islands. Four different sites with ridges were randomly selected on the ground, identified on air photos, ridge dimensions, substrate, vegetation cover and type recorded. The unconsolidated sediment of the upper ridge portions proved to be unfavorable for supporting a permanent vegetation cover. Consequently the upper part of the ridge surface remained barren yielding a lighter tone quality due to unvegetated sandy, silty material which provided a conspicuous contrast with the surroundings. (Author)

A76-33233 # Difficulties in determining meaningful spectral signatures of forest tree canopies. J. Vlcek (Toronto, University, Toronto, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 805-811. Research supported by the Department of the Environment of Canada.

Determination of spectral reflectance curves of forest tree canopies presents many difficult problems. Some of these are: need

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for elevated observation platforms, lack of suitable field spectroradiometric equipment, need to monitor incident irradiance, bidirectional character of reflectance phenomena, 3-dimensionality of forest crown canopy, biomass, topographical conditions of the terrain, site characteristics of the stand and others. This article describes an attempt to determine, in situ, spectral signatures of several tree species found in Gatineau Park and Larose Experimental Forest in the vicinity of Ottawa, Canada. Special emphasis was placed on replicability of data so that their statistical properties could be assessed. The results show a great difficulty in finding 'clean' signatures that could be termed characteristic of the species measured. This is attributed to large statistical variation of the signatures and also to the fact that, toward the end of the growing season, the spectral differences among trees become less pronounced. (Author)

A76-33684 **Processing of remotely sensed photographs for estimating forest resources.** A. K. S. Gopalan, N. K. Vyas, and D. S. Kamat (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India). (*Symposium on Earth's Near Space Environment, New Delhi, India, Feb. 18-21, 1975.*) *Indian Journal of Radio and Space Physics*, vol. 5, Mar. 1976, p. 28-30.

A technique for processing aerial photographs (scale of 1:25,000 or 1:6000) for the estimation of the number of trees of a certain species randomly disturbed over a large area. A relationship is established between the average reflectance of an area and the number of trees it contains, assuming that the background reflectance is smooth and textureless. The set-up for the optical processing of the images consists of an He-Ne laser as light source, high frequency spatial filters to block unwanted background spectrum, and a dc stop used to increase the dynamic range of the measuring system. The reconstructed picture is focused on a photomultiplier tube and the amplified photomultiplier output is plotted against the number of trees on the imagery. B.J.

A76-34715 # **Experiment in determining the phytopathological state of potato crops from spectral brightness coefficients (Opyt opredeleniia fitopatologicheskogo sostoiianiia posevov kartofelia po koeffitsientam spektral'noi iaskosti).** V. V. Vql'vach and P. P. Fedchenko (Glavnoe Upravlenie Gidrometeorologicheskoi Sluzhby SSSR, Institut Eksperimental'noi Meteorologii, Obninsk, USSR). *Meteorologiya i Gidrologiya*, Mar. 1976, p. 89-94. 8 refs. In Russian.

The paper describes an experiment on the feasibility of using remote sensing techniques for determining the degree of damage to a potato crop due to phytofluorosis. It was attempted to relate the pathological state of crop segments, which had been artificially inoculated over the course of the period of their full growth, to the reactions of the plants to visible and near IR radiation. A photometer was developed which permits study of the reflectivity of plants in six spectral regions and determination of the most informative ones regarding the pathological state of potato crops. P.T.H.

A76-35003 * # **The Large Area Crop Inventory Experiment (LACIE) - An assessment after one year of operation.** R. B. MacDonald, F. G. Hall, and R. B. Erb (NASA, Johnson Space Center, Houston, Tex.). In: *International Symposium on Remote Sensing of Environment*, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 17-37.

A Large Area Crop Inventory Experiment (LACIE) has been undertaken jointly by the U.S. Department of Agriculture (USDA), the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce and the National Aeronautics and Space Administration (NASA) to prove out an economically important application of remote sensing from space. The first phase of the Experiment, which focused upon determinations of wheat area in the U.S. Great Plains and upon the development and testing of yield models, is now nearing completion. The system implemented to handle and analyze the Landsat and meteorological data has

generally worked well and met operational goals. A very preliminary assessment of results to date indicates that the accuracy goals of the experiment can be met. (Author)

A76-35047 # **Remote sensing of wetlands in Virginia.** M. E. Penney and H. H. Gordon (Virginia Institute of Marine Science, Gloucester Point, Va.). In: *International Symposium on Remote Sensing of Environment*, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 495-503. 14 refs.

The paper discusses the environmental management details of wetlands, with particular reference to technicalities involving the use of ERTS data with LARS analysis for inventorying wetlands and low-altitude film imagery analysis to determine plant community parameters. The results indicate that the inventory attempt using ERTS and LARS unsupervised cluster analysis is inadequate for wetlands management and research purposes. Pixel size is too large (about 1 acre) to be practically useful even if wetlands and uplands have high spectral contrast. Wetlands and uplands are shown to be spectrally very similar by LARS analysis. Attempts at predicting new values of plant community parameters from film and position measurements using multiple regression techniques proved to be unsuccessful. Future plans are discussed. S.D.

A76-35056 # **'Heat capacity mapping' - Is it feasible.** A. Rosema (Netherlands Interdepartmental Working Community for the Application of Remote Sensing Techniques, Delft, Netherlands). In: *International Symposium on Remote Sensing of Environment*, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 571-582. 10 refs.

Several approaches to thermal modeling potentially applicable in heat capacity mapping of rock and soil properties are assessed and compared. It is shown that when the latent heat flux, or both the latent and sensible heat fluxes, are ignored in a model such as that proposed by Watson (1975), daily surface amplitudes may differ by a factor of two, dependent on the surface relative humidity. The amplitude and absolute level of the daily temperature wave can be reduced by the introduction of a function dependent on atmospheric stability. The RADMOD thermal model (Rosema, 1975), which includes soil moisture transport, provides a more satisfactory approach. A faster modeling approach, which incorporates the main features of the RADMOD thermal model and may be checked with it, is recommended for use after a period of dry weather. The moisture flow problem is solved for stationary conditions, and the thickness of the dry top soil layer is found. If the thickness is nil, the heat flow problem is solved as that of a fully evaporating soil; otherwise the heat flow is treated as a two-layer problem in which evaporation is ignored. C.K.D.

A76-35078 # **Remote sensing of landslide hazards on quick clays of Eastern Canada.** H. Gagnon (Ottawa, University, Ottawa, Canada). In: *International Symposium on Remote Sensing of Environment*, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 803-810. 5 refs.

A system for landslide detection is developed through twenty factors established from aerial imagery analysis of many landslides that occurred on post-glacial marine silts and clays of Eastern Canada. A landslide risk score is given for every piece of land. The system distinguishes slope factors from upper surface factors (terrace) and allows the separation of slump risks from clayey outflow risks. Some examples are mentioned. (Author)

A76-35094 # **Correlation of ERTS spectra with rock/soil types in Californian grassland areas.** S. Levine (Stanford University, Stanford, Calif.). In: *International Symposium on Remote Sensing of Environment*, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceed-

ings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 975-984.

A76-35102 # Airphoto analysis in the tropics - Crop identification. W. R. Philipson and T. Liang (Cornell University, Ithaca, N.Y.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1079-1092. 14 refs.

Keys for identifying major crops of the tropics on medium scale, panchromatic aerial photographs are developed, based on directly and indirectly observable field, management and crop features. Crops considered include sugar cane, lowland rice, maize, tobacco, pineapple, banana, rubber, coconut, coffee and cacao. (Author)

A76-35103 # A total timber resource inventory based upon manual and automated analysis of Landsat-1 and supporting aircraft data using stratified multistage sampling techniques. S. Titus, M. Gialdini, and J. Nichols (California, University, Berkeley, Calif.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1093-1099. 6 refs.

A76-35104 # The reflectance properties of grazing pastures as determined in the Landsat satellite bandpasses and from oblique colour-infrared aerial photography. M. J. Duggin (Commonwealth Scientific and Industrial Research Organization, Div. of Mineral Physics, Sydney, Australia), R. J. Roberts (Commonwealth Scientific and Industrial Research Organization, Div. of Entomology, Armidale, New South Wales, Australia), and J. M. George (Commonwealth Scientific and Industrial Research Organization, Div. of Animal Physiology, Armidale, New South Wales, Australia). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1101-1109. 15 refs. Research supported by the Wool Research Trust Fund.

A76-35105 # On the feasibility of monitoring croplands with radar. T. F. Bush and F. T. Ulaby (University of Kansas Center for Research, Inc., Lawrence, Kan.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1111-1121. 8 refs.

Results are presented for an experimental program directed at relating the variations in radar backscatter coefficient of corn, alfalfa, and wheat to measurable crop parameters. In support of the scattering measurements, ground-truth data are also required, including soil moisture content, plant height, precipitation, wet plant mass, and dry plant mass; the latter two measurements allow calculation of the plant moisture content. Major conclusions are that (1) radar backscatter coefficient of wheat as measured during its final 30 days of maturity is an increasing function of plant development, with the rate of change of the coefficient serving to estimate progress and time of harvest; (2) scatter coefficient of alfalfa is a decreasing function of plant maturity (height), with the coefficient variations being accounted for with a nonlinear regression equation containing plant height, plant moisture, and soil moisture; and (3) incidence angles of not less than 40 deg are imperative to monitor the growth of corn with radar. S.D.

A76-35107 # Remote sensing applications for agricultural fields in Japan. H. Shimoda, T. Sakata, and K. Nakamura (Tokai University, Hiratsuka, Kanagawa, Japan). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1133-1140.

A76-35110 # Accuracy of forest mapping from Landsat computer compatible tapes. Z. Kalensky (Canadian Forestry Service, Forest Management Institute, Ottawa, Canada) and L. R. Scherk (Computing Devices Co., Ltd., Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1159-1167.

Results of a two-year study on computerized processing of Landsat-1/MSS digital imagery are summarized. The study examined the applicability of Landsat multispectral images recorded on computer compatible tapes (CCTs) to forest mapping. A supervised classification was based on the Gaussian maximum-likelihood decision rule. The input imagery consisted of CCTs of Landsat scenes and their multitime combinations. Reported are accuracies and consistencies of computerized delineation and identification of the coniferous forest, deciduous forest, and nonforest land as a function of the date of Landsat scene and their multitime combinations. Included also are results obtained from single- and multitime processing of Landsat imagery. The overall classification accuracies ranged from 67% to 81% for single-date imagery and were consistently above 80% for multitime combinations. (Author)

A76-35111 # Measuring 'forage production' of grazing units from Landsat MSS data. D. W. Deering, J. W. Rouse, Jr., R. H. Haas, and J. A. Schell (Texas A & M University, College Station, Tex.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1169-1178.

Analysis techniques have been developed for obtaining quantitative assessments of the amount and seasonal condition of rangeland vegetation from Landsat-1 multispectral scanner (MSS) data. Correlations of MSS data, corrected for sun angle, with coincident ground truth data showed the difference between the red and infrared bands to be a useful measure of the green biomass of vegetation systems. On the basis of these results, a Transformed Vegetation Index using MSS Bands 7 and 5 values (TVI) or Bands 6 and 5 values (TVI6) was developed. The relationship between Landsat TVI6 data and ground estimates of green biomass was used to derive a green biomass estimation model for a Texas rangeland test site. The green biomass per pixel, estimated in increments of 250 to 300 kg/hectare, is displayed on CRT system, and grazing unit boundaries are superimposed for computation of total green biomass per grazing unit.

C.K.D.

A76-35113 * # Results from the crop identification technology assessment for remote sensing/CITARS/ project. R. M. Bizzell, F. G. Hall, A. H. Feiveson (NASA, Johnson Space Center, Earth Observations Div., Houston, Tex.), M. E. Bauer, B. J. Davis (Purdue University, West Lafayette, Ind.), W. A. Malila, and D. P. Rice (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1189-1198. 19 refs.

The CITARS (Crop Identification Technology Assessment for Remote Sensing) task design, objectives, and results are reviewed along with relevant conclusions and recommendations. The principal assessment concern crop identification performance for corn and soybeans in six sites in Illinois and Indiana. Use of quantitative measures of classification performance and statistical evaluations of the results have been important parts of the technology assessment. Relation of crop and sensor characteristics is discussed. Factors affecting crop identification performance are identified as crop maturity and site characteristics, type of single-date automatic data processing procedure used for local recognition, nonlocal recognition with and without processing for extension of recognition signatures,

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and use of multirate or multitemporal data. In particular, the probability of correct classification of field center pixels is not well correlated and thus is not a reliable indicator of proportion estimation performance. S.D.

A76-35114 # Estimation of moisture content of forest fuels over the southeastern U.S. using satellite data. M. Waters, III (NOAA, National Environmental Satellite Service, Suitland, Md.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1199-1208. 9 refs.

Results are presented for a study intended to develop an automated method to estimate the 1-hour timelag fuel moisture 1-HR TLFM component of the National Fire Danger Rating System for an approximate 210 by 260 mile area using digitized visible and infrared geosynchronous meteorological satellite data augmented with selected surface measures of air temperature and relative humidity. The estimated 1-HR TLFM is analyzed for time and space variations and compared to 1-HR TLFM determined at forest fire danger stations within the study area. Major conclusions are that automated estimation of 1-HR TLFM can be made hourly and that distribution of cloud cover can be monitored and mapped each half-hour from satellite visible data to indicate surface isolation patterns. S.D.

A76-35115 # Landsat applications in Canadian forestry. L. Sayn-Wittgenstein (Canadian Forestry Service, Forest Management Institute, Ottawa, Canada) and J. M. Wightman (Environment Canada, Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1209-1218. 29 refs.

Recent Canadian research involving the use of Landsat data in forestry is discussed. Special attention is given to the value of satellite imagery in assessing insect damage, particularly that due to infestations of spruce budworm. Stands susceptible to damage have been successfully mapped for spraying from Landsat data using the Bendix Multispectral Analyzer Display system. Estimation of the extent of budworm damage is hindered by its cumulative nature. Burn patterns can be effectively delineated with a significant cost savings over conventional methods. Burns are outlined from bands 6 and 7, and bands 4 and 5 are analyzed to detect smoke plumes. Storm damage in forests can be readily detected. Work towards the Canadian national monitoring and sampling project involving the use of Landsat data to produce forest resource and environmental statistics from a grid of several hundred sample points is in developmental stages. C.K.D.

A76-35116 # Investigations on the thermal behaviour of plants affected by virus and fungus diseases - Tobacco mosaic virus in *Nicotiana tabacum* L. cv. Xanthi nc., and *Uromyces appendiculatus* /pers./ link in *Phaseolus vulgaris* L. C. De Carolis (Milano, Università, Milan, Italy), G. G. Conti (CNR, Gruppo Virus e Virosi delle Piante, Milan, Italy), and G. M. Lechi (CNR, Istituto per la Geofisica della Litosfera, Milan, Italy). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1219-1229. 11 refs.

Variations in the radiance of *Nicotiana tabacum* cv. Xanthi and bean plants infected with tobacco mosaic virus (TMV) and *Uromyces appendiculatus*, respectively, were studied. Radiometric measurements were made in the 2-5.6 micron band from a distance of 20 cm. An initial decrease in the radiance of TMV-infected plants was attributed to abrasion of the leaves during mechanical inoculation. The radiance of infected leaves increased with the appearance of necrotic lesions and continued to rise during maturation of the symptoms. The local lesion area was much less radiant than

surrounding tissue. A pronounced decrease in radiance was observed in diseased bean plants starting from the 7-8th day after inoculation. This effect was probably due to increased transpiration resulting from breakage of the leaf surface during eruption of uredospores, and was most evident on the 13-14th day after inoculation, when the blisters were fully mature. C.K.D.

A76-35134 * # Evaluation of thermography as an aid to scheduling the harvest of sugarbeet storage piles to minimize spoilage losses. D. G. Moore, S. Bichsel, and R. Best (South Dakota State University, Brookings, S. Dak.; American Crystal Sugar Co., Moorhead, Minn.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1427-1436. Research supported by the American Crystal Sugar Co.; Grant No. NGL-42-003-007.

A76-36468 * # Remote sensing of soil moisture. T. Schmugge (NASA, Goddard Space Flight Center, Greenbelt, Md.). COSPAR, Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper. 26 p. 9 refs.

The surface emissivity and reflectivity of soil are strong functions of its moisture content. Changes in emissivity, observed by passive microwave techniques (radiometry), and changes in reflectivity, observed by active microwave techniques (radar), can provide information on the moisture content of the 0 to 5 cm surface layer. In addition, the thermal inertia of the surface layer, which can be remotely sensed by observing the diurnal range of surface temperature, is an indicator of soil moisture content. The thermal infrared approach to remote sensing of soil moisture has little utility in the presence of cloud cover, but provides soil moisture data at high spatial resolutions and thermal data which are a potentially useful indicator of crop status. Microwave techniques can penetrate cloud covers. The passive technique has been demonstrated by both aircraft and spacecraft instruments, but spatial resolution is limited by the size of the antenna which can be flown. Active microwave systems offer the possibility of better spatial resolution, but have yet to be demonstrated from aircraft or spacecraft platforms. C.K.D.

A76-38111 # Spectral signatures of forest trees. Z. Kalensky and D. A. Wilson (Canadian Forestry Service, Forest Management Institute, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings.

Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 155-171. 6 refs.

Described are the field measurements of daylight radiation reflected upwards from the crowns of six tree species in visible and near-infrared frequencies of the electromagnetic spectrum. A portable mast and two permanent towers provided platforms for a spectroradiometer at a height of 3 to 5 m above the tree canopy. Each site was measured on at least two different dates between late June and early September to account for variations in species phenological stages during the summer season. In addition, some of the species were measured in two different locations to account for differences in site conditions. Described are the instruments used for the measurement of incident and reflected daylight radiation, the field measurement technique and computational procedure. Presented are the reflectance data of tree species and their variations calculated from the field spectroradiometric data measured in the 1974 season. Their relevance for multispectral remote sensing and image interpretation is discussed. (Author)

A76-38114 # Landsat imagery for Banff and Jasper National Parks inventory and management. C. L. Kirby, P. Van Eck (Environment Canada, Northern Forest Research Centre, Edmonton, Alberta, Canada), D. Goodenough (Canada Centre for Remote Sensing, Ottawa, Canada), and D. Day (Environment Canada, Calgary, Alberta, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings.

Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 207-225. 14 refs.

Computer assisted classifications of Landsat digital magnetic tapes of Banff and Jasper National Parks were made. Themes of pine, spruce and poplar-shrub forest, water, snow and meadows were classified by their spectral signatures. From 70 to 80% of the four areas studied were classified with 80 to 90% accuracy using a supervised parallelepiped classification method. Extension of the classification from small training areas of 50-100 sq km in each Landsat image to classification of 1200 sq km areas at full resolution was done successfully on two Landsat images. The classifications produced were geometrically correct in color at a scale of 1:250,000 on an electron beam image recorder. Proposed applications of this work are in a biophysical inventory and in a National Park public education program. (Author)

A76-38118 # Monitoring nesting success of greater snow geese by means of satellite imagery. J. D. Heyland (Quebec Department of Tourism, Game and Fish, Biological Research Div., Orsainville, Quebec, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 243-256. Research supported by the Quebec Department of Tourism, Game and Fish.

A76-38119 # Mapping of forest clear-cutting, south Vancouver Island, from Landsat imagery. P. A. Murtha and E. K. Watson (British Columbia, University, Vancouver, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 257-263. 6 refs.

Three successive dates of Landsat imagery were used to map the progression of clear-cutting on southern Vancouver Island. Two types of mapping were tried. The first used the single black and white band-5 image and a Kail reflecting projector. The resulting map was an inferior product because it was concluded that a combination of bands 5 and 6 were required for mapping of the clear-cuts. A color-additive viewer was also used. The subsequent maps from the color combined 70-mm, positive-transparency, density-matched images showed only the locations of clear-cuts. Enlargements of the positive images to a mapping scale of 1:150,000 enabled interpretation of 8 mapping classes, including an estimation of percent vegetation cover on recently clear-cut areas. It was concluded that monitoring of the progression of clear-cutting at the enlarged scale not only involved estimations of relative locations, but permitted an estimate of revegetation, or locating areas of poor regeneration. The areas of poor regeneration were closely related to parent materials. (Author)

A76-38120 # Reliability of estimating clear-cut and uncut mature timber areas using Landsat imagery. Y. J. Lee (Department of the Environment, Pacific Forest Research Centre, Victoria, British Columbia, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 265-272. 5 refs.

Landsat imagery use in identifying three distinct types of forest acreage of economic interest (areas clear-cut within the past year, areas clear-cut for over one year, and uncut mature forest stands) is described. Enhancement of Landsat data through the use of color additive viewers and enhancement of data by digital techniques (on computer-compatible tapes) are compared, and application of the Image 100 interactive supervised classification system is described. Areas clear-cut for over a year showed the greatest variety in spectral reflectance (given the variety of underbrush, grass, replanted forest stands, burned slash). The color additive viewer technique works best in enhancement of images of most recent clear-cuttings. R.D.V.

A76-38121 # The monitoring of timber harvesting and forest fires in Alberta. E. Winquist and C. Jackson (Alberta Forest Service, Edmonton, Canada). In: Canadian Symposium on Remote

Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 273-280.

A76-38125 # Remote sensing applied to algal problems in lakes. G. R. Lawrence and C. W. Graham (Ministry of Natural Resources, Ontario Centre for Remote Sensing, Toronto, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings.

Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 309-314.

Landsat multispectral scanner imagery, low-altitude color IR photography, and in situ field sampling techniques, are combined in a study of the variation of algal population, appearance of algal blooms on the lake surface, and variations in spectral signature of surface water of the Lake of the Woods region in south central Canada (west Ontario, bordering Minnesota of USA). Spume, or buildup of dead algae on the surface, shows up as white wispy lines in the imagery. Filtration and exposure recommendations for color IR photography are indicated. The high IR reflectivity of chlorophyll and near 100% IR absorption of clear water provide strong contrast. Algal blooms often indicate pollution problems. R.D.V.

A76-38129 # A regional level of wetlands mapping for the Northern Clay Section of Ontario. A. N. Boissonneau (Ontario Centre for Remote Sensing, Toronto, Canada) and J. K. Jeglum (Great Lakes Forest Research Centre, Sault Sainte Marie, Ontario, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 349-357. 5 refs.

A76-38132 # Remote sensing - An aid to pipeline and hydro tower construction in agricultural areas. C. W. Graham (Ontario Centre for Remote Sensing, Toronto, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 383-391. 7 refs.

A research program pursued by OCRS (Ontario Centre for Remote Sensing) for detecting the presence of drainage tiles in a proposed pipeline course in southern Ontario is described. Construction of pipeline and hydro tower structures in agricultural areas where topography and soil conditions require installation of subsurface drainage tiles can adversely affect the efficiency of moisture removal from the soil. OCRS thermal scanner imagery and photogrammetric surveying were combined to aid location of subsurface tiles. Spring photography yielded best results. R.D.V.

A76-38136 # Agricultural crop prediction. J. C. Woodward. In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 423-425.

The importance of worldwide reliable estimates of crop-raising conditions and food supplies is stressed, and the effect of forecasting on crop yield, assuming availability of reliable statistics on production and demand lead to related action, is considered. Historical data and information on climate and weather are considered crucial, in particular data on soil moisture conditions as a factor directly affecting crop productivity. Survival of biennial and perennial crops through winterkilling hazards is also taken into consideration. R.D.V.

A76-38137 # Agricultural crop reflectance studies using Landsat-1 data. L. S. Crosson (Canada Department of Agriculture, Saskatoon, Saskatchewan, Canada), F. G. Peet (Canadian Forestry Service, Forest Management Institute, Ottawa, Canada), and D. W. L. Read (Canada Department of Agriculture, Swift Current,

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Saskatchewan, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, *Proceedings*. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 427-433. Research supported by the Canada Department of Agriculture.

During 1973 cloud free Landsat-1 data was obtained for a site near Swift Current, Saskatchewan for June 8, July 14, August 1, August 19 and September 6 which, with the exception of the June 26 pass, provided complete 18-day sequential coverage for the entire growing season from seeding to harvest. The mean spectral reflectance values for spring wheat, durum wheat, barley, flax, native pasture, seeded pasture and summer fallow varied differently during the growing season and tentatively implied that spring wheat may be isolated from all the crops except durum wheat by using temporal data. However, when 95% confidence limits were calculated for the mean spectral values it was found that wheat could be isolated only from native pasture, seeded pasture and summer fallow because of overlap in spectral reflectance with the other crops. Since the spectral reflectances of durum wheat, barley and flax overlap with native pasture, seeded pasture and summer fallow as well as wheat a high classification accuracy could not be expected for any crop if all crop classes were included in the classification. (Author)

A76-38138 # Monitoring cereal cover crops in southwestern Alberta using colour-infrared aerial photography and Landsat-1 data. T. G. Atkinson, A. D. Kuzyk (Agriculture Canada, Lethbridge, Canada), and M. D. Rigby. In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, *Proceedings*. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 435-447. 5 refs. Research sponsored by the Canada Centre for Remote Sensing.

A76-38139 # The cooperative Canada-US crop prediction project - Crop classification. A. R. Mack (Agriculture Canada, Research Branch, Ottawa, Canada), F. Peet (Environment Canada, Forest Management Institute, Ottawa, Canada), and L. Crosson (Saskatchewan Institute of Pedology, Saskatoon, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, *Proceedings*. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 449-456. 10 refs.

A summary of the classification of crops on 14 locations in the spring wheat area of North America for over 42 Landsat-1 images showed that percentage correctly identified varied between 50.9 to 100% in 1973 for the 'Cereal' class (wheat, oats, barley). The level of accuracy varied with the date of imagery selected and with the criteria used to characterize the accuracy. The number of orbital passes of cloud-free and error-free images was usually about 2 out of 4 for the period from mid-June to late August. Most of the useable imagery in 1973 occurred in August (14 passes) as compared to July (11 passes). The number of images processed for 1974 dropped because of unavailable satellite or photographic data by December, 1974. (Author)

N76-22620*# Oregon State Univ., Corvallis.
RELATIONSHIPS BETWEEN VEGETATION AND TERRAIN VARIABLES IN SOUTHEASTERN ARIZONA Ph.D. Thesis David A. Mouat, Principal Investigator Jun. 1974 258 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (E76-10299; NASA-CR-146792) Avail: NTIS HC \$9.00 CSCL 08F

The author has identified the following significant results. Relationships were established between eight terrain variables and plant species and 31 vegetation types. Certain plant species are better than others for differentiating or discriminating groups of specified terrain variables. Certain terrain variables are better than others for differentiating or discriminating groups of vegetation types. Stepwise discriminant analysis was shown to be a useful tool in plant ecological studies.

N76-22623*# Commission of the European Communities, Ispra (Italy).

AGRICULTURAL RESOURCES INVESTIGATIONS IN NORTHERN ITALY AND SOUTHERN FRANCE (AGRESTE PROJECT). PART 1: ITALIAN TEST-SITES Progress Report, 15 Aug. - 15 Nov. 1975

Sergio Finzi, Principal Investigator 15 Nov. 1975 54 p refs Sponsored by NASA ERTS (E76-10304; NASA-CR-146820; PR-1) Avail: NTIS HC \$4.50 CSCL 02C

N76-22624*# Commission of the European Communities, Ispra (Italy).

AGRESTE PROGRAM. PART 2: FRENCH TEST-SITES Quarterly Report, Dec. 1975 - Jan. 1976

Sergio Finzi, Principal Investigator Jan. 1976 92 p refs In ENGLISH; partly in FRENCH Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (E76-10305; NASA-CR-146822) Avail: NTIS HC \$5.00 CSCL 02C

N76-22628*# Geological Survey, Miami, Fla.
SUBTROPICAL WATER-LEVEL DYNAMICS DISTRIBUTION Progress Report

A. L. Higer, Principal Investigator and L. J. Swayze Feb. 1976 3 p ERTS (E76-10310; NASA-CR-146558) Avail: NTIS HC \$3.50 CSCL 08F

N76-22630*# Agricultural Research Service, Weslaco, Tex.
SOIL, WATER, AND VEGETATION CONDITIONS IN SOUTH TEXAS Quarterly Progress Report, 13 Jan. - 13 Apr. 1976 Craig L. Wiegand, Harold W. Gausman, Ross W. Leamer, Arthur J. Richardson, James H. Everitt, and Alvin H. Gerbermann, Principal Investigators Apr. 1976 21 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(NASA Order S-53876-AG) (E76-10313; NASA-CR-146825) Avail: NTIS HC \$3.50 CSCL 08F

The author has identified the following significant results. Software development for a computer-aided crop and soil survey system is nearing completion. Computer-aided variety classification accuracies using LANDSAT-1 MSS data for a 600 hectare citrus farm were 83% for Redblush grapefruit and 91% for oranges. These accuracies indicate that there is good potential for computer-aided inventories of grapefruit and orange citrus orchards with LANDSAT-type MSS data. Mean digital values of clouds differed statistically from those for crop, soil, and water entities, and those for cloud shadows were enough lower than sunlit crop and soil to be distinguishable. The standard errors of estimate for the calibration of computer compatible tape coordinate system (pixel and record) to earth coordinate system (longitude and latitude) for 6 LANDSAT scenes ranged from 0.72 to 1.50 pixels and from 0.58 to 1.75 records.

N76-22641*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
USE OF SATELLITES IN THE STUDY OF TROPICAL VEGETATION

M. Soto, A. Gomez-Pompa, F. Menendez, and G. Arp Washington NASA Mar. 1976 11 p refs Transl. into ENGLISH of "Uso de los Satelites en el Estudio de la Vegetacion Tropical" (unpublished report), Mexico City, Mexico Univ., 1976 8 p (Contract NASw-2789) (NASA-TT-F-16941) Avail: NTIS HC \$3.50 CSCL 08F

Potential vegetation and actual vegetation maps are compared. For the study of Veracruz, a map combining these types as well as the various methods normally used was attempted. Data used for the study came from the MSS of the ERTS 1 satellite. From these, grey maps of the different radiances of the area were obtained, as well as isoclass programs. The latter were found to have the best results. Though much research still needs to be done, first results indicate that this methodology can revolutionize all the concepts and methods of evaluation and inventory of terrestrial vegetation resources. Author

N76-23657*# Mekong Committee Secretariat, Bangkok (Thailand).

AGRICULTURE/FORESTRY HYDROLOGY Quarterly Report, Dec. 1975 - Feb. 1976

W. J. VanDerOord, Principal Investigator Apr. 1976 29 p refs
Sponsored by NASA ERTS
(E76-10330; NASA-CR-147211; Rept-2) Avail: NTIS
HC \$4.00 CSCL 08F

N76-23659*# Atomic Energy Commission, Dacca (Bangladesh).
A STUDY OF THE HAOR AREAS OF SYLHET-MYMENSING DISTRICTS WITH ERTS IMAGERIES (WINTER CROP ESTIMATION)

Anwar Hossain, Principal Investigator, A. M. Choudhury, A. Azim, S. Ahmed, and S. Rahman 1976 5 p refs Presented at 1st Ann. Bangladesh Sci. Conf., Dacca, Bangladesh, 28-31 Mar. 1976
Sponsored by NASA ERTS
(E76-10333; NASA-CR-147214) Avail: NTIS HC \$3.50 CSCL 02C

N76-23661*# Department of Agriculture, Washington, D.C. Statistical Reporting Service.

CROP IDENTIFICATION AND ACREAGE MEASUREMENT UTILIZING LANDSAT IMAGERY Final Report

Donald H. VonSteen, Principal Investigator and William H. Wigton Mar. 1976 206 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (NASA Order S-70251-AG)
(E76-10336; NASA-CR-147219) Avail: NTIS HC \$7.75 CSCL 02C

N76-23666*# Kanner (Leo) Associates, Redwood City, Calif.
FUNDAMENTALS OF THE METHOD OF FORECASTING THE HARVEST OF WINTER GRAIN CROPS IN THE NON-CHERNOZEM ZONE

M. S. Kulik Washington NASA May 1976 44 p refs
Transl. into ENGLISH from Tr. Inst. Eksperimental'nogo Meteorol. (Leningrad), no. 8, 1969 p 3-21
(Contract NASw-2790)

(NASA-TT-F-17039) Avail: NTIS HC \$4.00 CSCL 02C

Many data are given on various aspects of winter crop yields in different areas of the U.S.S.R., and connections with various soil and climatic factors are presented. Regression equations are formulated and tested with good results, for forecasting moisture supplies in the 20 cm plowed layer of soil. Data and discussions are presented on the effect of the fall growing period, thermal conditions, conditions at the start of spring, spring growing conditions and of improvement in agricultural technology on winter crop harvests. Author

N76-23667*# Transemanatics, Inc., Washington, D.C.

SATELLITES MAP THE HARVEST

Eric Dyring NASA May 1976 17 p Transl. into ENGLISH from Forsch. och Fransteg (Germany), no. 3, 1976 p 46-51
(Contract NASw-2792)

(NASA-TT-F-15498) Avail: NTIS HC \$3.50 CSCL 02C

Some few of the world's countries dominate the international food market by virtue of their overwhelming agricultural and technical resources. This creates what has been called food power, which is assuming increasing strategic importance in world politics. At the same time, a large part of the world's population suffers from lack of food. The way toward a just distribution of the world's food is through political decisions, but this can be broadened with the help of modern technology. In the United States, a large project has been working for more than a year to map harvests with the help of satellite observations and large-scale analysis techniques. Such methods can be effective aids against hunger in the world at the same time as they threaten to become a weapon in the struggle of the great powers in the world arena. Author

N76-23668*# Lockheed Electronics Co., Plainfield, N.J.

CROP IDENTIFICATION TECHNOLOGY ASSESSMENT FOR REMOTE SENSING (CITARS). VOLUME 10: INTERPRETATION OF RESULTS

R. M. Bizzell, A. H. Feiveson, F. G. Hall, M. E. Bauer (Purdue Univ.), B. J. Davis (Purdue Univ.), W. A. Malila (Environ. Res. Inst. of Michigan, Ann Arbor), and D. P. Rice (Environ. Res. Inst. of Michigan, Ann Arbor) Dec. 1975 107 p refs
(Contract NAS9-12200)

(NASA-CR-147718; LEC-4326h-Vol-10; JSC-09393-Vol-10)
Avail: NTIS HC \$5.50 CSCL 02C

The CITARS was an experiment designed to quantitatively evaluate crop identification performance for corn and soybeans in various environments using a well-defined set of automatic data processing (ADP) techniques. Each technique was applied to data acquired to recognize and estimate proportions of corn and soybeans. The CITARS documentation summarizes, interprets, and discusses the crop identification performances obtained using (1) different ADP procedures; (2) a linear versus a quadratic classifier; (3) prior probability information derived from historic data; (4) local versus nonlocal recognition training statistics and the associated use of preprocessing; (5) multitemporal data; (6) classification bias and mixed pixels in proportion estimation; and (7) data with different site characteristics, including crop, soil, atmospheric effects, and stages of crop maturity. Author

N76-23671*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REMOTE SENSING OF VEGETATION AND SOIL USING MICROWAVE ELLIPSOMETRY Patent Application

Siegfried O. Auer (NAS-NRC) and John B. Schutt, inventors (to NASA) Filed 15 Apr. 1976 15 p
(Contract NSR-09-01-087)
(NASA-Case-GSC-11976-1; US-Patent-Appl-SN-677352) Avail: NTIS HC \$3.50 CSCL 14B

A method of determining vegetation height and water content of vegetation from the intensity and state of elliptical polarization of a reflected train of microwaves is described. The method comprises the steps of reflecting a circularly polarized train of microwaves from vegetation at a predetermined angle of incidence, detecting the reflected train of microwaves, determining the ratio of the intensities of the electric field vector components, measuring the phase difference of the components, and computing the refractive index and thickness of the layer of vegetation from a formula, wherein the refractive index is given essentially by the water content of the vegetation. NASA

N76-23672*# Texas A&M Univ., College Station. Remote Sensing Center.

OPERATION OF AGRICULTURAL TEST FIELDS FOR STUDY OF STRESSED CROPS BY REMOTE SENSING Final Report, 1 Jun. 1973 - 30 Sep. 1974

Robert W. Toler 10 Oct. 1974 62 p refs
(Contract NAS9-13545)

(NASA-CR-147710) Avail: NTIS HC \$4.50 CSCL 02C

A test site for the study of winter wheat development and collection of ERTS data was established in September of 1973. The test site is a 10 mile square area located 12.5 miles west of Amarillo, Texas on Interstate Hwy. 40, in Randall and Potter counties. The center of the area is the Southwestern Great Plains

Research Center at Bushland, Texas. Within the test area all wheat fields were identified by ground truth and designated irrigated or dryland. The fields in the test area other than wheat were identified as to pasture or the crop that was grown. A ground truth area of hard red winter wheat was established west of Hale Center, Texas. Maps showing the location of winter wheat fields in excess of 40 acres in size within a 10 mile radius were supplied NASA. Satellite data was collected for this test site (ERTS-1). Author

N76-23785*# Transemanatics, Inc., Washington, D.C.
PRELIMINARY RESULTS OF UHF RADIOMETRIC AND DIRECT GROUND STUDIES OF SOIL MOISTURE IN 1975. REPORT OF THE SOVIET-AMERICAN WORKING GROUP
 A. Ye. Basharinov, I. M. Butenko, L. A. Parshina, Ye. A. Reutov, A. A. Chukhlantsev, and A. M. Shutko Washington NASA May 1976 20 p Transl. into ENGLISH from Predvaritel'nyye Rezul'taty SVCh radiometricheskikh i pryamykh nazemnykh issled. vlazhnosti pochv, v 1975 g. (Otchet sovetsko-amerikanskoy gruppy) (USSR), 1976 19 p (Contract NASw-2792)

(NASA-TT-F-17053) Avail: NTIS HC \$3.50 CSCL 08M

Data regarding characteristics of weather conditions, methods and certain data of ground measurements of soil parameters, UHF radiometric equipment, tasks and methods of measurements, and certain results of integrated measurements are investigated. Figures include location of measurement regions, characteristics of the state of a number of fields in the agricultural region, characteristic profiles on relative humidity, data of spatial variations in radiobrightness on the wave of 3.4 cm. Results of ground measurements of relative humidity, data of profile measurements, dependence of soil emissivity, and spectral dependence of the degree of radiobrightness decrease over the region of ground water on the Arabat spit are given. Author

N76-24655*# Oregon State Univ., Corvallis.
THE IDENTIFICATION OF SELECTED VEGETATION TYPES IN ARIZONA THROUGH THE PHOTOINTERPRETATION OF INTERMEDIATE SCALE AERIAL PHOTOGRAPHY M.S. Thesis

George Franklin Ross, Principal Investigator Dec. 1973 155 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (Contract NAS5-21831)

(E76-10300; NASA-CR-146793) Avail: NTIS HC \$6.75 CSCL 08F

The author has identified the following significant results. Nine photography interpretation tests were performed with a total of 19 different interpreters. Three tests were conducted with black and white intermediate scale photography and six tests with color infrared intermediate scale photography. The black and white test results show that the interpretation of vegetation mapped at the association level of classification is reliable for all the classes used at 61%. The color infrared tests indicate that the association level of mapping is unsatisfactory for vegetation interpretation of classes 1 and 6. Students' t-test indicated that intermediate scale black and white photography is significantly better than this particular color infrared photography for the interpretation of southeastern Arizona vegetation mapped at the association level.

N76-24663*# Kansas Univ., Lawrence. Space Technology Center.

A COMPREHENSIVE DATA PROCESSING PLAN FOR CROP CALENDAR MSS SIGNATURE DEVELOPMENT FROM SATELLITE IMAGERY Progress Report

R. M. Haralick, Principal Investigator 1 Apr. 1976 177 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-20943)

(E76-10343; NASA-CR-147235; TR-286-2; PR-2) Avail: NTIS HC \$7.50 CSCL 05B

N76-24664*# Nebraska Univ., Lincoln.

THE USE OF LANDSAT-1 IMAGERY IN MAPPING AND MANAGING SOIL AND RANGE RESOURCES IN THE SAND HILLS REGION OF NEBRASKA Final Report, Jun. 1972 - May 1974

Paul M. Seevers, Principal Investigator and James V. Drew Jan. 1976 86 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21756)

(E76-10344; NASA-CR-147236) Avail: NTIS HC \$5.00 CSCL 08B

The author has identified the following significant results. Evaluation of ERTS-1 imagery for the Sand Hills region of Nebraska has shown that the data can be used to effectively measure several parameters of inventory needs. (1) Vegetative biomass can be estimated with a high degree of confidence using computer compatible tape data. (2) Soils can be mapped to the subgroup level with high altitude aircraft color infrared photography and to the association level with multitemporal ERTS-1 imagery. (3) Water quality in Sand Hills lakes can be estimated utilizing computer compatible tape data. (4) Center pivot irrigation can be inventoried from satellite data and can be monitored regarding site selection and relative success of establishment from high altitude aircraft color infrared photography. (5) ERTS-1 data is of exceptional value in wide-area inventory of natural resource data in the Sand Hills region of Nebraska.

N76-24670*# National Marine Fisheries Service, Bay Saint Louis, Miss.

LANDSAT MENHADEN AND THREAD HERRING RESOURCES INVESTIGATION Progress Report, 31 Jan. - 30 Apr. 1976

Kenneth Savastano, Principal Investigator, Andres J. Kemmerer (NASA, Slidell Computer Complex); and Kenneth Faller May 1976 35 p refs EREP

(NASA Order S-54114)

(E76-10350; NASA-CR-147241; SEFC-Contrib-454;

MARMAP-Contrib-119; Rept-3) Avail: NTIS HC \$4.00 CSCL 08A

N76-24678*# Earthsat Corp., Washington, D.C.

EARTHSAT SPRING WHEAT YIELD SYSTEM TEST 1975, APPENDIX 4

Apr. 1976 331 p refs

(Contract NAS9-14655)

(NASA-CR-147712; E/S-1052-App-4)

Avail: NTIS

HC \$10.00 CSCL 02C

A computer system is presented which processes meteorological data from both ground observations and meteorologic satellites to define plant weather aspects on a four time per day basis. Plant growth stages are calculated, and soil moisture profiles are defined by the system. The EarthSat system assesses plant stress and prepares forecasts of end-of-year yields. The system was used to forecast spring wheat yields in the upper Great Plains states. Hardware and software documentation is provided. A.S.K.

N76-24680*# Old Dominion Univ., Norfolk, Va. Dept. of Biology.

MAPPING FOREST VEGETATION WITH ERTS-1 MSS DATA AND AUTOMATIC DATA PROCESSING TECHNIQUES

J. Messmore, G. E. Copeland, and G. F. Levy [1975] 18 p refs

(Grant NGL-47-003-067)

(NASA-CR-148136) Avail: NTIS HC \$3.50 CSCL 08B

This study was undertaken with the intent of elucidating the forest mapping capabilities of ERTS-1 MSS data when analyzed with the aid of LARS automatic data processing techniques. The site for this investigation was the Great Dismal Swamp, a 210,000 acre wilderness area located on the Middle Atlantic coastal plain. Due to inadequate ground truth information on the distribution of vegetation within the swamp, an unsupervised classification scheme was utilized. Initially pictureprints, resembling low resolution photographs, were generated in each

of the four ERTS-1 channels. Data found within rectangular training fields was then clustered into 13 spectral groups and defined statistically. Using a maximum likelihood classification scheme, the unknown data points were subsequently classified into one of the designated training classes. Training field data was classified with a high degree of accuracy (greater than 95 percent), and progress is being made towards identifying the mapped spectral classes. Author

N76-24683*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESULTS OF SOIL MOISTURE FLIGHTS DURING APRIL 1974

Thomas J. Schmugge, Bruce J. Blanchard, William J. Burke, Jack F. Paris, and James R. Swang Washington May 1976 58 p refs
(NASA-TN-D-8199; G-7663) Avail: NTIS HC \$4.50 CSCL 08M

The results presented here are derived from measurements made during the April 5 and 6, 1974 flights of the NASA P-3A aircraft over the Phoenix, Arizona agricultural test site. The purpose of the mission was to study the use of microwave techniques for the remote sensing of soil moisture. These results include infrared (10-to 12 micrometers) 2.8-cm and 21-cm brightness temperatures for approximately 90 bare fields. These brightness temperatures are compared with surface measurements of the soil moisture made at the time of the overflights. These data indicate that the combination of the sum and difference of the vertically and the horizontally polarized brightness temperatures yield information on both the soil moisture and surface roughness conditions. Author

N76-25604*# Oregon State Univ., Corvallis.
MULTISEASONAL-MULTISPECTRAL REMOTE SENSING OF PHENOLOGICAL CHANGE FOR NATURAL VEGETATION INVENTORY Ph.D. Thesis

Barry James Schrumph, Principal Investigator 5 Mar. 1975 227 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10302; NASA-CR-146795) Avail: NTIS HC \$8.00 CSCL 08F

The author has identified the following significant results. Variations in phenological development among plant species was noted, as well as the tendency for the seasonal appearance of some vegetation types to be dominated by the appearance of one or a few similarly developing species. Most of the common plants in the study area could be characterized by temporal aspects of their phenological development. There was a strong similarity among the spectral signatures of vegetation types in which the spectral return was dominated by green plant material. When the soil background dominated the spectral return from a vegetation stand, then the spectral radiance and the vegetation physiognomy were apparently related. When the deciduous shrubs lost their leaves, their spectral signature altered with a slight decrease of radiance in the visible wavelengths and a strong decrease in the near infrared. As the foliage of perennial grasses cured from August to November, its apparent green radiance remained unchanged, red radiance increased over 50 percent, and near infrared radiance decreased approximately 30 percent. A reflective mineral surface exhibited high radiance levels in all four bands, thus providing a marked contrast to the absorption characteristics of vegetation canopies.

N76-25607*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. INVESTIGATION OF SOIL EROSION IN HOKKAIDO WHICH IS CAUSED BY THAWING OF SOIL WATER IN LATE SPRING Quarterly Progress Report, Jan. - Mar. 1976

Takakazu Maruyasu and Shigechika Hayashi, Principal Investigators Mar. 1976 4 p Sponsored by NASA and Science and Technol. Agency, Tokyo Original contains imagery. Original

photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10360; NASA-CR-147954) Avail: NTIS HC \$3.50 CSCL 08H

N76-25623*# Northern Prairie Wildlife Research Center, Jamestown, N. Dak.

APPLICATION OF LANDSAT SYSTEM FOR IMPROVING METHODOLOGY FOR INVENTORY AND CLASSIFICATION OF WETLANDS Progress Report, 4 Oct. - 31 Dec. 1975
David S. Gilmer, Principal Investigator and Edgar A. Work, Jr. 5 Jan. 1976 3 p ERTS
(NASA Order S-54049-A)
(E76-10378; NASA-CR-147971) Avail: NTIS HC \$3.50 CSCL 08B

N76-25624*# California Univ., Berkeley. Space Sciences Lab.

STUDY-DEVELOPMENT OF IMPROVED PHOTOINTERPRETATIVE TECHNIQUES TO WHEAT IDENTIFICATION Quarterly Progress Report, 15 May - 15 Aug. 1975

Claire M. Hay and Randall W. Thomas, Principal Investigators 17 Sep. 1975 40 p refs EREP
(Contract NAS9-14565)
(E76-10379; NASA-CR-144630) Avail: NTIS HC \$4.00 CSCL 02F

N76-25626*# Zurich Univ. (Switzerland). Dept. of Geography.

SNOW SURVEY AND VEGETATION GROWTH IN THE SWISS ALPS Final Report

Harold Haefner, Principal Investigator Dec. 1975 39 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(E76-10381; NASA-CR-147395) Avail: NTIS HC \$4.00 CSCL 08L

The author has identified the following significant results. Analog processing of S190A and B color and infrared color transparencies showed that it is possible to evaluate the courses of the temporary snow line and the upper limit of vegetation growth over large areas. By transferring the results from S190A onto a topo-map 1:200,000, an accuracy of + or - 50 m could be achieved. With S190B transferred onto a map 1:100,000, an accuracy of + or - 20 m was reached. Digital processing of S192 multispectral data allowed a separation of snow and clouds by combining the information from channels 9, 15, and 18.

N76-25627*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

A FORESTRY APPLICATION SIMULATION OF MAN-MACHINE TECHNIQUES FOR ANALYZING REMOTELY SENSED DATA

J. Berkebile, James Russell, and Bruce Lube 7 May 1976 75 p refs
(Contract NAS9-14016)
(NASA-CR-147663; LARS-IN-012376; T-1039/4) Avail: NTIS HC \$4.50 CSCL 05B

The typical steps in the analysis of remotely sensed data for a forestry applications example are simulated. The example uses numerically-oriented pattern recognition techniques and emphasizes man-machine interaction. Author

N76-25629*# Colorado State Univ., Fort Collins. Dept. of Earth Resources.

EXTRACTING SCENE FEATURE VECTORS THROUGH MODELING, VOLUME 3 Final Report

Joseph K. Berry and James A. Smith Apr. 1976 174 p refs
(Contract NAS9-14467)
(NASA-CR-147742) Avail: NTIS HC \$6.75 CSCL 02C

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The remote estimation of the leaf area index of winter wheat at Finney County, Kansas was studied. The procedure developed consists of three activities: (1) field measurements; (2) model simulations; and (3) response classifications. The first activity is designed to identify model input parameters and develop a model evaluation data set. A stochastic plant canopy reflectance model is employed to simulate reflectance in the LANDSAT bands as a function of leaf area index for two phenological stages. An atmospheric model is used to translate these surface reflectances into simulated satellite radiance. A divergence classifier determines the relative similarity between model derived spectral responses and those of areas with unknown leaf area index. The unknown areas are assigned the index associated with the closest model response. This research demonstrated that the SRVC canopy reflectance model is appropriate for wheat scenes and that broad categories of leaf area index can be inferred from the procedure developed. Author

N76-25636* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF SOIL MOISTURE
T. Schmugge Jun. 1976 25 p refs Presented at Symp. C., Cospar Meeting, Philadelphia, Pa., 8 Jun. 1976
(NASA-TM-X-71127; X-913-76-118) Avail: NTIS HC \$3.50 CSCL 08M

The results of thermal and microwave studies of soil moisture are presented, and the relative advantage of each method is discussed. L.S.

N76-25708* Bittinger (M.W.) and Associates, Inc., Fort Collins, Colo.
SOIL MOISTURE GROUND TRUTH: STEAMBOAT SPRINGS, COLORADO, SITE AND WALDEN, COLORADO.
SITE Mission Report, 8-10 Mar. 1976
E. Bruce Jones Apr. 1976 54 p refs
(Contract NAS5-22312)
(NASA-CR-144757) Avail: NTIS HC \$4.50 CSCL 08M

Ground-truth data taken at Steamboat Springs and Walden, Colorado in support of the NASA missions in these areas during the period March 8, 1976 through March 11, 1976 was presented. This includes the following information: snow course data for Steamboat Springs and Walden, snow pit and snow quality data for Steamboat Springs, and soil moisture report. Author

N76-26612 Colorado State Univ., Fort Collins.
SPECTRAL ESTIMATION OF GRASS CANOPY VEGETATIONAL STATUS Ph.D. Thesis
Compton James Tucker, III 1975 121 p
Avail: Univ. Microfilms Order No. 76-13669

The relationships between spectroradiance and the sampled plot variables (total wet biomass, total dry biomass, leaf water, dry green biomass, dry brown biomass, and chlorophyll) of a blue grama grass canopy were evaluated as a function of wavelength for two sampling periods, one early in the growing season and one late in the growing season. The sensitivities between canopy spectroradiance or spectrorreflectance and the sampled plot variables have been in turn related to the absorption spectra of the plant pigments in the visible region of the spectrum and the enhancement of spectroradiance or spectrorreflectance occurring in the photographic infrared region. The number of total wet biomass classes or levels that could be spectrally discriminated late in the growing season (September) were investigated using analysis of variance methods. Dissert. Abstr.

N76-26615* International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands).
THE INTERPRETATION OF ERTS-1 IMAGERY FOR SOIL SURVEY OF THE MERIDA REGION, SPAIN Final Report, May 1973 Jun. 1974
F. W. Hilwig, D. Goosen, Principal Investigators, and D. Katsieris Sep. 1975 29 p refs Sponsored by NASA and Netherlands Geophysical Space Res. Commission ERTS
(E76-10384; NASA-CR-148151; SR-0569/4) Avail: NTIS HC \$4.00 CSCL 08B

The author has identified the following significant results. Major landforms and some subdivisions could be easily recognized. Water bodies, river courses, extensive areas of miocene clays, and more recent coarse textured deposits could be delineated and existing soil maps at scales up to 1:100,000 could be updated.

N76-26621* California Univ., Berkeley. Space Sciences Lab.
AN INVENTORY OF IRRIGATED LANDS WITHIN THE STATE OF CALIFORNIA BASED ON LANDSAT AND SUPPORTING AIRCRAFT DATA Quarterly Progress Report, 25 Jan. - 25 Apr. 1976
Robert N. Colwell, Principal Investigator, Sharon Wall, and Dennis Noren 25 Apr. 1976 17 p ref ERTS
(Contract NAS5-20969)
(E76-10393; NASA-CR-148180; SSL-Ser-17-Issue-27) Avail: NTIS HC \$3.50 CSCL 08B

N76-26622* Alaska Univ., Fairbanks. Alaska Cooperative Wildlife Research Unit.
USE OF LANDSAT IMAGERY FOR WILDLIFE HABITAT MAPPING IN NORTHEAST AND EASTCENTRAL ALASKA Progress Report
Peter C. Lent, Principal Investigator 6 May 1976 28 p refs ERTS
(Contract NAS5-20915)
(E76-10394; NASA-CR-148181; PR-4) Avail: NTIS HC \$4.00 CSCL 08B

The author has identified the following significant results. There is strong indication that spatially rare feature classes may be missed in clustering classifications based on 2% random sampling. Therefore, it seems advisable to augment random sampling for cluster analysis with directed sampling of any spatially rare features which are relevant to the analysis.

N76-26627* Environmental Research Inst. of Michigan, Ann Arbor.
WHEAT PRODUCTIVITY ESTIMATES USING LANDSAT DATA Progress Report, 16 Feb. - 15 May 1976
Richard F. Nalepka, John Colwell, Principal Investigators, and Daniel P. Rice 15 May 1976 6 p ERTS
(Contract NAS5-22389)
(E76-10399; NASA-CR-148186; ERIM-114800-16-LpPR-4) Avail: NTIS HC \$3.50 CSCL 02C

N76-26629* California Univ., Berkeley. Space Science Lab.
ERTS-1 DATA AS AN AID TO WILDLAND RESOURCE MANAGEMENT IN NORTHERN CALIFORNIA Final Report, 1 Jul. 1973 - 31 Dec. 1974
Robert N. Colwell and James D. Nichols, Principal Investigators 31 Dec. 1974 487 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21827)
(E76-10401; NASA-CR-148188; SSL-Ser-16-Issue-62) Avail: NTIS HC \$12.50 CSCL 05A

The author has identified the following significant results. In the Feather River watershed region, detection of wildland resource features and conditions was done acceptably well on single-bank, single-date ERTS-1 imagery. A quasi-operational study was performed and demonstrated that ERTS-1 imagery is ideal for making vegetation/terrain type maps using manual interpretation techniques. Two quasi-operational studies demonstrated that timer inventories could be made using multistage sampling. A number of Chi square analyses of Northern California coast were performed; it was concluded that the boundaries delineated on the ERTS-1 imagery were legitimate for broad vegetation-type categories.

N76-26637* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PART 1: THE USE OF LANDSAT DATA IN LACIE

R. B. MacDonald, F. G. Hall, and R. B. Erb *In its* NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 43-62 refs

CSCL 02C

The major factors which influenced the large area crop inventory experiment design, the technical approach being pursued, the detail of the implementation of this approach, and initial results of the experiment are described. Author

N76-26638* National Oceanic and Atmospheric Administration, Houston, Tex.

THE LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PART 2: YIELD ESTIMATES FROM METEOROLOGICAL INFORMATION

Paul J. Waite *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 63-65 refs

CSCL 02C

Crop-weather models developed for wheat from an assembled base of approximately 45 years of climatic records and historic wheat yield and production data at the stratum level are described. Utilization of meteorological data acquired by the NOAA satellites is discussed. J.M.S.

N76-26639* Department of Agriculture, Houston, Tex.

THE LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PART 3: A SYSTEMATIC APPROACH TO THE PRACTICAL APPLICATION OF REMOTE-SENSING TECHNOLOGY

Jimmy D. Murphy and Raymond I. Dideriksen *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 66-77

CSCL 02C

The application of remote sensing technology by the U.S. Department of Agriculture (USDA) is examined. The activities of the USDA Remote-Sensing User Requirement Task Force which include cataloging USDA requirements for earth resources data, determining those requirements that would return maximum benefits by using remote sensing technology and developing a plan for acquiring, processing, analyzing, and distributing data to satisfy those requirements are described. Emphasis is placed on the large area crop inventory experiment and its relationship to the task force. J.M.S.

N76-26641* Cargill, Inc., Minneapolis, Minn.

AGRICULTURE, SUMMARY

Richard Baldwin *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 83-97

CSCL 02C

Applications of remotely sensed data in agriculture are enumerated. These include: predictions of forage for range animal consumption, forest management, soil mapping, and crop inventory and management. J.M.S.

N76-26677# North Central Forest Experiment Station, St. Paul, Minn.

INTRODUCTION TO USES AND INTERPRETATION OF PRINCIPAL COMPONENT AND ANALYSIS IN FOREST BIOLOGY Forest Service General Technical Report

J. G. Isebrands and Thomas R. Crow Jan. 1976 24 p refs (PB-248753/6; FSGTR-NC-17) Avail: NTIS HC \$3.50 CSCL 02F

The application of principal component analysis for interpretation of multivariate data sets is reviewed with emphasis on reduction of the number of variables, ordination of variables, and applications in conjunction with multiple regression. GRA

N76-27625*# Texas A&M Univ., College Station. Remote Sensing Center.

APPLIED REGIONAL MONITORING OF THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION IN THE GREAT PLAINS CORRIDOR Progress Report, Feb. - Apr. 1976

John W. Rouse, Jr., Principal Investigator May 1976 22 p refs ERTS

(Contract NAS5-20796)

(E76-10406; NASA-CR-148219; RSC-3018-5) Avail: NTIS HC \$3.50 CSCL 08F

The author has identified the following significant results. A TV16 isoline map at the 6.25 million hectare extended test site area in north central Texas and southern Oklahoma was produced. The map was compared to a published USDA Statistical Reporting Service map, which shows pasture and range feed conditions as reported by rancher respondents. Both maps show similar areas of drought stress and good to excellent forage conditions, but preliminary indications are that the LANDSAT-derived map more accurately depicts the areal extent of each condition class.

N76-27630*# South Dakota State Univ., Brookings. Remote Sensing Inst.

SOIL MOISTURE AND EVAPOTRANSPIRATION PREDICTIONS USING SKYLAB DATA Final Report, 1 Mar. 1973 - 30 Sep. 1975

V. I. Myers, Principal Investigator, D. G. Moore, M. L. Horton, and M. J. Russell 30 Sep. 1975 97 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP.

(Contract NAS9-13337)

(E76-10413; NASA-CR-147441; SDSU-RSI-75-09) Avail: NTIS HC \$5.00 CSCL 08M

The author has identified the following significant results. Multispectral reflectance and emittance data from the Skylab workshop were evaluated for prediction of evapotranspiration and soil moisture for an irrigated region of southern Texas. Wavelengths greater than 2.1 microns were required to spectrally distinguish between wet and dry fallow surfaces. Thermal data provided a better estimate of soil moisture than did data from the reflective bands. Thermal data were dependent on soil moisture but not on the type of agricultural land use. The emittance map, when used in conjunction with existing models, did provide an estimate of evapotranspiration rates. Surveys of areas of high soil moisture can be accomplished with space altitude thermal data. Thermal data will provide a reliable input into irrigation scheduling.

N76-27634*# ECON, Inc., Princeton, N.J.

A PRELIMINARY STUDY OF THE STATISTICAL ANALYSES AND SAMPLING STRATEGIES ASSOCIATED WITH THE INTEGRATION OF REMOTE SENSING CAPABILITIES INTO THE CURRENT AGRICULTURAL CROP FORECASTING SYSTEM

Francis Sand and Robert Christie 30 Jun. 1975 90 p refs (Contract NASw-2558)

(NASA-CR-148154; Rept-75-127-1) Avail: NTIS HC \$5.00 CSCL 02B

Extending the crop survey application of remote sensing from small experimental regions to state and national levels requires that a sample of agricultural fields be chosen for remote sensing of crop acreage, and that a statistical estimate be formulated with measurable characteristics. The critical requirements for the success of the application are reviewed in this report. The problem of sampling in the presence of cloud cover is discussed. Integration of remotely sensed information about crops into current agricultural crop forecasting systems is treated on the basis of the USDA multiple frame survey concepts, with an assumed addition of a new frame derived from remote sensing. Evolution of a crop forecasting system which utilizes LANDSAT and future remote sensing systems is projected for the 1975-1990 time frame. Author

01 AGRICULTURE AND FORESTRY

N76-27635*# ECON, Inc., Princeton, N.J.

UNITED STATES BENEFITS OF IMPROVED WORLDWIDE WHEAT CROP INFORMATION FROM A LANDSAT SYSTEM Final Report

Klaus P. Heiss, Francis Sand, Andrew Seidel, Dennis Warner, Neil Sheflin, R. Bhattacharyya, and John Andrews 31 Aug. 1975 241 p refs

(Contract NASw-2558)

(NASA-CR-148158; Rept-76-122-1B) Avail: NTIS HC \$8.00 CSCL 02B

The value of worldwide information improvements on wheat crops, promised by LANDSAT, is measured in the context of world wheat markets. These benefits are based on current LANDSAT technical goals and assume that information is made available to all (United States and other countries) at the same time. A detailed empirical sample demonstration of the effect of improved information is given; the history of wheat commodity prices for 1971-72 is reconstructed and the price changes from improved vs. historical information are compared. The improved crop forecasting from a LANDSAT system assumed include wheat crop estimates of 90 percent accuracy for each major wheat producing region. Accurate, objective worldwide wheat crop information using space systems may have a very stabilizing influence on world commodity markets, in part making possible the establishment of long-term, stable trade relationships. Author

N76-27647*# Joint Publications Research Service, Arlington, Va.

METHODS FOR SURVEYING TO DETERMINE THE IMPORTANCE OF FORESTS IN WATERSHEDS USING SATELLITE IMAGERY

Chamni Bunyaphat, Buchana Klankhamson, and Thongchai Charuphaphat Washington NASA Jul. 1976 19 p Transl. into ENGLISH from Forest Management Div. Forestry Dept. (Bangkok), 1975 p 1-18

(NASA Order W-13183)

(NASA-TT-F-17064) Avail: NTIS HC \$3.50 CSCL 02F

Surveys of some of the river valleys in northern Thailand were initiated for the following reasons: (1) to determine the level of importance of forests in various river valleys, (2) to determine an advantageous use of the land in each category of importance, (3) to aid in the control of land use in these areas, and (4) to monitor land use in these areas. Multispectral scanner and return beam vidicon data obtained by the LANDSAT satellites and Skylab were utilized. Detailed instructions are given for image interpretation. D.M.L.

N76-27652*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

ANALYSIS OF FIELD SIZE DISTRIBUTIONS, LACIE TEST SITES 5029, 5033, AND 5039, ANHWEI PROVINCE, PEOPLE'S REPUBLIC OF CHINA

Melvin H. Podwysocki Jun. 1976 12 p ref Submitted for publication

(NASA-TM-X-71156; X-923-76-145) Avail: NTIS HC \$3.50 CSCL 08B

A study was made of the field size distributions for LACIE test sites 5029, 5033, and 5039, People's Republic of China. Field lengths and widths were measured from LANDSAT imagery, and field area was statistically modeled. Field size parameters have log-normal or Poisson frequency distributions. These were normalized to the Gaussian distribution and theoretical population curves were made. When compared to fields in other areas of the same country measured in the previous study, field lengths and widths in the three LACIE test sites were 2 to 3 times smaller and areas were smaller by an order of magnitude.

Author

N76-27654*# Bittinger (M. W.) and Associates, Inc., Fort Collins, Colo.

SOIL-MOISTURE GROUND TRUTH, HAND COUNTY, SOUTH DAKOTA

E. Bruce Jones Apr. 1976 53 p ref

(Contract NAS5-22312)

(NASA-CR-144781) Avail: NTIS HC \$4.50 CSCL 08M

Soil types were determined from the Soil Survey of Hand County, South Dakota. The soil types encountered on the soil moisture lines are summarized. The actual soil moisture data are presented. The data have been divided by range, township and section. The soil moisture data obtained in fields of winter wheat and spring wheat are briefly summarized. Author

N76-27656# Royal Netherlands Meteorological Inst., De Bilt. **NIGHT FROST. ORIGIN OF THE PHENOMENON AND MEANS AND METHODS TO PREVENT OR LIMIT DAMAGE [NACHTVORST. ONTSTAAN VAN HET VERSCHIJNSEL EN MIDDELEN EN METHODEN OM SCHADE TE VOORKOMEN OF TE BEPERKEN]**

M. Scharringa [1976] 104 p refs In DUTCH

(VO-5) Avail: NTIS HC \$5.50; Staatsdrukkerij Gerard Bouwman DFI 9.85

The physical processes resulting in night frost are described. Night frost is the meteorological situation in which the air temperature and the temperature of protruding objects near the earth's surface descend below freezing point at night but rise above this during daytime. In agriculture night frost is of importance mainly in the growth season. Methods and means to limit or prevent damage are dealt with. These include passive methods such as choice of the land, and choice of the growth season, and active methods such as glass, plastic or metal covers, and watering. ESA

ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.

A76-29137 Atmospheric water vapor measurements with an infrared /10-micron/ differential-absorption lidar system. E. R. Murray, R. D. Hake, Jr., J. E. van der Laan, and J. G. Hawley (Stanford Research Institute, Menlo Park, Calif.). *Applied Physics Letters*, vol. 28, May 1, 1976, p. 542, 543. 15 refs. NSF Grant No. AEN-73-10596A01.

The recent design, construction, and operation of the first infrared differential-absorption lidar system for remote range-resolved sensing of gaseous species are described. The target gas in the present case was water vapor, which was measured using several CO₂ laser lines near 10.3 microns. Profiling of the concentration of many air pollutants to a horizontal range of at least 12 km appears feasible with commercially available components. (Author)

A76-29234 Use of monostatic sodar in probing the lower atmosphere. S. P. Singal, B. S. Gera, S. K. Aggarwal, and M. Saxena (National Physical Laboratory of India, New Delhi, India). (*Symposium on Earth's Near Space Environment, New Delhi, India, Feb. 18-21, 1975.*) *Indian Journal of Radio and Space Physics*, vol. 4, June 1975, p. 146-156. 39 refs.

A collocated monostatic sodar system which used a reflector horn as a transmit-receive antenna was used to investigate the thermal structure of the lower atmosphere. A facsimile recording was made of the typical thermal plume structure formed on a bright sunny day and the radiative temperature inversion structure formed on a clear windless night. Wavelike structures were observed in the vertical and horizontal planes in the troposphere. The horizontal wave motion was superimposed on the stratified layers, had a time period of a few minutes, was discontinuous and lasted many hours, while the vertical wave motion was very regular, had a period of a fraction of a second and was short lived. B.J.

A76-29267 Aircraft measurements of the earth's albedo over India. A. Mani (Indian Meteorological Department, New Delhi, India), O. Chacko, V. Desikan, and G. Vijayan (Indian Meteorological Department, Poona, India). (*Symposium on Earth's Near Space Environment, New Delhi, India, Feb. 18-21, 1975.*) *Indian Journal of Radio and Space Physics*, vol. 4, Dec. 1975, p. 304-309.

Satellite observations of the earth albedo consistently indicate that the earth is a warmer and darker planet than was previously believed and that more solar energy is absorbed by the atmosphere than hitherto accepted. In order to verify these observations, direct measurements of the albedo of various surfaces were made on the ground at a number of stations in India and from aircraft over extensive land and sea areas. Two thermoelectric pyranometers were used to measure the global and reflected solar radiation, the data being continuously recorded in flight. These data were supplemented by observations over the Arabian sea from an oceanographic ship during 1974. The measurements show that the albedo over land varies from 0.10-0.25, depending on the nature of the surface and that over the sea from 0.04-0.13 depending on the state of the sea. The albedo of clouds varies from 0.40-0.60 for active cumulus to 0.25-0.35 for altostratus. (Author)

A76-30466 # Measurement of the ratio of atmospheric water vapor mixture in the stratosphere and mesosphere with a spectral apparatus mounted on the Salyut-4 orbital base (Izmereniia smesi atmosfernogo vodianogo para v stratosfere i

mezofere s pomoshch'iu spektral'noi apparatury, ustanovlennoi na orbital'noi stantsii 'Saliut-4'). K. Ia. Kondrat'ev, A. A. Buznikov, G. M. Grechko, A. A. Gubarev, and A. G. Pokrovskii (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR). *Akademiia Nauk SSSR, Doklady*, vol. 226, Jan. 21, 1976, p. 563-565. 14 refs. In Russian.

The atmospheric humidity at heights above 30 km was measured during January and February 1975 with an IR spectrometer mounted externally on the Salyut-4 satellite. The measurements were carried out in the 2.7-micron absorption band of water vapor. The vertical absorption spectrum of IR radiation (by water vapor) in the upper stratosphere above the Marshall Islands is presented and discussed. V.P.

A76-31436 # Influence of the earth's atmosphere on earth surveys - Selected examples: Transmission and emission (Einflüsse der Erdatmosphäre auf die Erdkundung - Ausgewählte Beispiele: Transmission, Emission). W. Renger (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Physik der Atmosphäre, Oberpfaffenhofen, West Germany). In: *Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports.* Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 125-149. 17 refs. In German.

The optical properties of the atmosphere in the range from 400 nm to 20 microns are reviewed, and their influence on optical remote sensing methods is discussed. Particular attention is given to the atmospheric windows and the influence of scattering and absorption on transmittance. Typical numerical data are presented and their influence on some optical remote sensing methods is demonstrated. The influence of atmospheric refraction of atmospheric emission is examined. V.P.

A76-31448 # Land use mapping from Landsat-1 and Skylab photography by conventional methods (Landnutzungskartierung aus Landsat-1 und Skylab aufnahmen mit konventionellen Methoden). J. Nithack, J. Bodechtel, G. di Bernardo, K. Hiller, F. Jaskolla, and A. Smolka (Zentralstelle für Geo-Photogrammetrie und Fernerkundung, Munich, West Germany). In: *Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports.*

Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 345-366. In German.

A 1:250,000 scale land use map of the mountain region of Italy was assembled on the basis of photographic enlargements of Landsat-1 MSS channel 5 and 7 images and Skylab normal color, false color, and spectral images interpreted with the aid of conventional techniques. The following first-order categories were distinguished according to grey tone, texture, and large-scale land profile photographs: wasteland, permanent snow, glaciers, settlement areas, grassland, cultivated areas, forest, and waters. In particular, the categories cultivated areas and forest can be further subdivided on the basis of the spectral behavior of the surface areas revealed through intensive comparisons of MSS 5 and 7 photographs taken at different times of the year, and from an overall knowledge of the land. P.T.H.

A76-31453 # Regional planning and remote sensing (Regionalplanung und Fernerkundung). A. v. Hesler (Regionale Planungsgemeinschaft, Frankfurt am Main, West Germany). In: *Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports.* Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 419-427. In German.

New opportunities and methods opened up for regional planning by advances in remote sensing are surveyed. Applications of electronic data processing and display techniques are also covered. Surfaces and curves used in plans include: land and forestry surfaces; residential, industrial, and technical developments; recreation and reserve areas; roads and streets; airports and waterways; energy and product supply lines; water supply lines; sewage plants and conduits.

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

Computerized-entry logs for updated information on thermal and chemical emissions from many sources, IR thermographic data, pollution and thermal effects on bodies of water, and ecological hazards, are described. West-German administrative rezoning, hiatus in statistics available, funding problems, and urban topography are mentioned. Visual and IR satellite photographic surveys and their value are discussed, along with possible periods of satellite surveys.

R.D.V.

A76-31454 # Infrared imagery for the evaluation of ecological sites and for urban buildings (Infrarotbilder für die ökologische Standortbewertung und für den Städtebau). F. Fezer (Heidelberg, Universität, Heidelberg, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 429-435. In German.

It is shown how airborne infrared radiometer imagery of ecologically important areas (forests, grasslands, etc.) and of urban areas can provide useful information on climatology. The infrared imagery which is indicative of surface temperature profiles gives a good idea of atmospheric temperature variations as well as wind direction and intensity variations. The analysis of imagery of urban areas permits one to draw conclusions about the interaction of climatology and urban ecology (heat stored and radiated by parks, trees, grassy areas in cities, as well as by buildings) and about urban planning on the basis of ecological and climatological information.

B.J.

A76-31457 # Urban-climatological conclusions from line-scanner recordings of the surface temperatures with respect to the diurnal variations /example Freiburg i. Br./ (Stadtklimatologische Konsequenzen von Line-Scanner-Aufnahmen der Oberflächen-temperaturen im Tagesgang /Beispiel Freiburg i. Br./). W. Weischet (Freiburg, Universität, Freiburg im Breisgau, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, Apr. 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 459-467. In German.

A description is given of studies which were conducted to determine intracity differences in the thermal conditions on the basis of the energy conversion processes in city areas of various characteristics. Infrared line scanner data of the city for three different times of the day were obtained with the aid of an aircraft. Line-scanner recordings were also made with an apparatus carried by a surface vehicle. A simplified model concerning the thermal conditions and relations for the various parts of the city is discussed, taking into account lawn areas, areas containing trees, the inner parts of the city, and the heat-storage properties of the streets, the squares, and the walls of buildings.

G.R.

A76-31472 # Natural error sources in remote sensing of the earth surface (Natürliche Fehlerquellen bei der Fernerkundung der Erdoberfläche). K.-T. Kriebel (München, Universität, Munich, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 669-676. In German.

The air light and the angular dependence of the reflection properties of natural objects on the earth surface are natural error sources in remote sensing. The angular dependence of the reflection properties affects the incident radiation when the distribution of incident radiation over a half space (or the direction of sight), but not the object itself, changes. The change in the reflected radiation is evaluated quantitatively, and a method for determining the upper bound for the air light is proposed.

V.P.

A76-31480 World-wide satellite surveillance of surface wind impact of a test case. V. J. Cardone and W. J. Pierson (New York, City University, New York, N.Y.). In: Technology for the new horizon; Proceedings of the Thirteenth Space Congress, Cocoa Beach,

Fla., April 7-9, 1976.

Cocoa Beach, Fla., Canaveral Council of Technical Societies, 1976, p. 3-7 to 3-20. 19 refs.

On Skylab, a combination microwave radar-radiometer (S193) made measurements from which the winds near the sea surface could be inferred. The analysis of the measurements showed that the wind speed could be computed from the radar measurements with at least the accuracy of the wind speed that would have been reported by a weather ship at the time and location of the radar measurement. The impact of this remote sensing capability will be realized in 1978 with the launch of SEASAT-A, which will carry operational versions of active and passive microwave sensors that will be able to measure both wind speed and direction. Global over ocean routine vector wind measurements should significantly improve the specification of the surface wind and indirectly the surface pressure over the oceans, determine the intensity and structure of tropical cyclones and contribute to improved accuracy of numerical weather forecasting models applied to both the tropics and extratropical atmosphere.

(Author)

A76-32427 Environmental quality pattern mapping from space data. I. Nakajima (Government Forest Experiment Station, Tokyo, Japan). In: International Symposium on Space Technology and Science, 11th, Tokyo, Japan, June 30-July 4, 1975, Proceedings. Tokyo, AGNE Publishing, Inc., 1975, p. 923-928. Research supported by the Government Forest Experiment Station.

A method is presented whereby satellite imagery can be used for constructing maps of environmental quality. The reflected light ratios obtained by Landsat-1 in the Kanto area were classified into six wavelength bands, corresponding to six categories of land surface conditions: forest, farmland, grassland, bare land, residential, dense urban, and water. This classification was applied to the Tokyo metropolitan area. Decreases in the degree of vegetation were found to be accompanied by proportionate increases in the density of atmospheric pollutants and surface heat per unit area. It is concluded that the extent of plant cover as determined from reflected light ratios in satellite imagery provides a useful indicator of environmental quality.

C.K.D.

A76-32431 * The measurement of winds over the ocean from Skylab with application to measuring and forecasting typhoons and hurricanes. V. J. Cardone and W. J. Pierson (New York, City University, Bronx, N.Y.). In: International Symposium on Space Technology and Science, 11th, Tokyo, Japan, June 30-July 4, 1975, Proceedings. Tokyo, AGNE Publishing, Inc., 1975, p. 949-959. 11 refs. Contract No. NAS9-13642.

On Skylab, a combination microwave radar-radiometer (S193) made measurements in a tropical hurricane (AVA), a tropical storm, and various extratropical wind systems. The winds at each cell scanned by the instrument were determined by objective numerical analysis techniques. The measured radar backscatter is compared to the analyzed winds and shown to provide an accurate method for measuring winds from space. An operational version of the instrument on an orbiting satellite will be able to provide the kind of measurements in tropical cyclones available today only by expensive and dangerous aircraft reconnaissance. Additionally, the specifications of the wind field in the tropical boundary layer should contribute to improved accuracy of tropical cyclone forecasts made with numerical weather predictions models currently being applied to the tropical atmosphere.

(Author)

A76-32432 An observation system of atmospheric pollutants using a satellite or an aircraft. K. Inamiya, K. Ito, and S. Ito (Mitsubishi Electric Corp., Kamakura, Kanagawa, Japan). In: International Symposium on Space Technology and Science, 11th, Tokyo, Japan, June 30-July 4, 1975, Proceedings. Tokyo, AGNE Publishing, Inc., 1975, p. 961-965. 8 refs.

The observation of atmospheric pollutants from a satellite or aircraft by means of an optical resonance absorption technique is

discussed. A ground-based laser transmits monochromatic light at a frequency coinciding with the absorption line of the pollutant of interest to an aircraft- or satellite-borne receiver. The signal is attenuated by absorption by the pollutant distributed along the path of light propagation; the density of the pollutant is determined from the degree of signal attenuation. The signal to noise ratio, sensitivity, and required laser output are given for several alternative systems. It is shown that a combination of satellite and aircraft data can provide measurements of pollutants over a wide range of altitudes. C.K.D.

A76-32810 The measurement of airborne particles. R. D. Cadle (National Center for Atmospheric Research, Boulder, Colo.). New York, Wiley-Interscience, 1975. 353 p. 341 refs. \$22.50.

The present work deals with the theory and methodology of aerosol particle measurement, with particular reference to the marketed instruments currently in use. Particle statistics and data presentation are reviewed with emphasis on recent developments. The featured subjects include collection of particles without classification by size; measurement of collected particles; optical measurements of aerosols; multistage impactors and centrifugal classifiers; methods for characterizing condensation nucleation, Brownian diffusion, electrical properties of the particles, and sedimentation; and sampling probes and lines. More space is devoted to filtration and optical microscopy than to many of the other subjects in order to promote their use to best advantage. S.D.

A76-33046 The amplitude distribution of field-aligned currents at northern high latitudes observed by Triad. T. Iijima and T. A. Potemra (Johns Hopkins University, Laurel, Md.). *Journal of Geophysical Research*, vol. 81, May 1, 1976, p. 2165-2174. 34 refs. NSF Grant No. DES-73-00593; Contract No. N00017-72-C-4401. NR Project 323-013.

A76-33081 Geomagnetic activity at the passage of high-speed streams in the solar wind. C. Sawyer (NOAA, Ocean Remote Sensing Laboratory, Miami, Fla.) and M. Haurwitz. *Journal of Geophysical Research*, vol. 81, May 1, 1976, p. 2435, 2436. 9 refs.

A76-33122 Land-use map accuracy criteria. R. M. Hord and W. Brooner (Earth Satellite Corp., Bethesda, Md.). *Photogrammetric Engineering and Remote Sensing*, vol. 42, May 1976, p. 671-677.

Statistical sampling procedures for determining the accuracy of classification and of boundary line and control point placement in photo-derived maps are presented. The approach involves the random selection of one-acre points, ground checking these points, and comparing a field observer's classification with that of the aerial photo interpreter. The accuracy of classification is then estimated within specified confidence intervals. The determination of boundary line errors is based on comparison of two or more raster maps of the same area. A binomial distribution is used to determine the minimum number of control points locations that must be checked to ensure that U.S. National Map Accuracy Standards are satisfied. C.K.D.

A76-33177 # Montana public land resource management applications of remote sensing. M. P. Meyer, B. H. Gerbig, J. A. Brass (Minnesota, University, Minneapolis, Minn.), H. R. Cosgriffe, and F. T. Batson (U.S. Department of the Interior, Bureau of Land Management, Billings, Mont.). In: *Symposium on Remote Sensing and Photo Interpretation*, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 5-15. 6 refs. Research supported by the U.S. Department of the Interior and University of Minnesota.

To meet the increasing demands for information on the public land resources in the face of inadequate budgets and personnel, remote sensing was selected by the USDI - Bureau of Land Management's Montana State Office to increase the capabilities of existing professional personnel. A 5-year series of field tests and

training, has resulted in: (1) a 'low-stage' inexpensive 35 mm aerial photography system now in use for monitoring range trend, wildlife habitat, water quality, erosion, structures, timber sales and archeological sites; (2) a 'middle-stage' system of 1:40,000-1:50,000 scale color infrared 23 x 23 cm photography for use as a data base for large area (circa 50,000 to 250,000 hectares) resource surveys; and (3) a 'high-stage' system of color infrared small scale 1:80,000 to 1:100,000 'quad-centered' photography applied to very large areas (circa 250,000 hectares) for use as an extensive resource survey data base. The applicability of ERTS data is also under study. (Author)

A76-33178 # Land use classification in Bavaria from aerial photographs and ERTS-1 imagery. H. S. Helbig (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Satellitenelektronik, Oberpfaffenhofen, West Germany). In: *Symposium on Remote Sensing and Photo Interpretation*, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 17-22.

A76-33179 * # Application of spatial features to satellite land-use analysis. J. Smith, R. Hornung, and J. Berry (Colorado State University, Fort Collins, Colo.). In: *Symposium on Remote Sensing and Photo Interpretation*, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 23-37. 11 refs. Contract No. NAS9-12972.

A Level I land-use analysis of selected training areas of the Colorado Front Range was carried out using digital ERTS-A satellite imagery. Level I land-use categories included urban, agriculture (irrigated and dryland farming), rangeland, and forests. The spatial variations in spectral response for these land-use classes were analyzed using discrete two-dimensional Fourier transforms to isolate and extract spatial features. Analysis was performed on ERTS frame 1352-17134 (July 10, 1973) and frame number 1388-17131 (August 15, 1973). On training sets, spatial features yielded 80 to 100 percent classification accuracies with commission errors ranging from 0 to 20 percent. (Author)

A76-33181 # New techniques in mapping urban land use and monitoring change for selected U.S. metropolitan areas - An experiment employing computer-assisted analysis of ERTS-1 MSS data. R. Ellefsen (San Jose State University, San Jose, Calif.), L. Gaydos (U.S. Geological Survey, Menlo Park, Calif.), P. Swain (Purdue University, Lafayette, Ind.), and J. R. Wray (U.S. Geological Survey, Washington, D.C.). In: *Symposium on Remote Sensing and Photo Interpretation*, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 51-63. 8 refs. Research supported by U.S. Geological Survey.

Successful experiments in mapping urban land use, through employment of pattern recognition algorithms in a digital computer by processing multispectral scanner data from Earth Resources Technology Satellite-1, have been conducted by researchers of the Geography Program, U.S. Geological Survey and the Laboratory for Applications of Remote Sensing, Purdue University. Map forms are computer line-printer output and colored prints from a film recorder. Numerous categories of land use and land cover were identified and mapped to make full use of the potential of the computer/scanner system. Several innovations in machine-aided analysis were developed in response to: (1) making rural/urban distinctions; (2) arranging data in map format; (3) aggregating results by statistical units; and (4) solving other peripheral problems. Recitation and critique of the evolved methodology reveals progress made, identifies limitations of the system, and suggests directions for future improvement. (Author)

A76-33183 # Objectified data for urban green-planning from CIR-aerial photography. H. Kenneweg (Göttingen, Universität, Göttingen, West Germany). In: *Symposium on Remote Sensing and Photo Interpretation*, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 75-86. 6 refs.

A simple method whereby data for the planning of green areas in urban environment can be extracted from color infrared aerial photography is presented. The number of trees with crowns over 5 m in diameter per statistical subunit are counted under a stereoscope, and the fraction of green vegetation per statistical subunit is determined by counting and classifying dots on a dot-grid. The results, expressed in terms of the number of inhabitants per tree or per square meter of green vegetation, can provide guidelines in establishing priority areas or the development of green areas of the active preservation of existing vegetation. C.K.D.

A76-33200 # Remote sensing for environmental monitoring and impact assessment. J. Thie (Department of Energy, Mines, and Resources, Canada Centre for Remote Sensing, Ottawa, Canada) and C. Wachmann (Environment Canada, Environmental Protection Service, Ottawa, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 301-316. 18 refs.

Monitoring of ecosystem dynamics is a key element in the development of strategies and methodologies for the most effective management of natural resources and in the development and implementation of measures to protect the environment. Remote sensing has been found to have a number of significant advantages and is being developed to serve the Canadian environmental needs. Remote sensing from ERTS, NOAA and from aircraft combined with selected field observations have provided an operational system for the monitoring and description of ecosystems as well as the assessment of environmental impact and effectiveness of control measures. A system for low cost, long term environmental monitoring for a large hydroelectric development in northern Canada is described. (Author)

A76-33203 # Remote sensing applications for geocological studies in the high mountain environment. H. Haefner (Zürich, Universität, Zurich, Switzerland). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 349-361. 10 refs.

Remote sensing data acquisition, interpretation, and organization for geocological studies in high mountains are discussed for two test areas in Switzerland. The paper outlines data acquisition techniques for collection of various thematic groups of surface features using different remote sensors, interpretation methods for inventory and combination of the data obtained, and organization of the data in geographical information systems for comparison and useful application in geocological studies. First results of data handling and data output for the two test areas are presented. Major conclusions are that various remote sensing systems are needed for data acquisition, that additional information from ground observation and other sources are important, and that a computerized geographical information system that stores the coded data in matrix form and allows geographical location of each single information provides the best basis for further processing and correlation. S.D.

A76-33206 # The application of aerial photographic interpretation to derelict land studies in South Wales. L. J. Gibson (Aston, University, Birmingham, England). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 389-401. 23 refs.

Studies of derelict land using aerial photographs have indicated the possibility of using the technique for surveying such land on a larger scale. The need for a survey is great, particularly, in the United Kingdom where land has to be used intensively for all urban and industrial activities. The old County of Glamorgan, South Wales, has been surveyed for derelict land using black and white vertical photographs of 1:5000 scale, and aspects of the survey are discussed with particular reference to mining. An example of the use of the resulting data is described by reference to a study which is trying to assess how dereliction influences the aesthetic quality of the landscape. (Author)

A76-33231 # Land use mapping by computer processing of satellite imagery. R. F. Mills (Pennsylvania, University, Philadelphia, Pa.). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 787-797.

A number of unsupervised classification systems have been developed for the Earth Resources Technology Satellite (ERTS) multispectral imagery on digital tape. Most suffer from being (1) too complex for use by those not highly trained in statistical methods/computer processing, (2) not as successful as supervised techniques, or (3) too costly in terms of computer time to be implemented with the size data set desired by many disciplines. Investigations are in progress to determine what degree of data manipulation will produce thematic maps of sufficient accuracy, resolution and scale to be readily applicable to natural resource and regional planning problems at costs competitive with more conventional methods. (Author)

A76-33800 Remote sensing for environmental sciences. Edited by E. Schanda (Bern, Universität, Berne, Switzerland). Berlin and New York, Springer-Verlag (Ecological Studies Analysis and Synthesis. Volume 18), 1976. 381 p. \$29.80.

Aspects of aerospace photography are considered, taking into account the characteristics of the photographic process, cameras and films, and the photographic attributes of earth sciences. Infrared sensing methods are discussed along with laser applications in remote sensing, radar methods, passive microwave sensing, applications of gamma radiation in remote sensing, and sonar methods. A description is also provided of digital picture processing, giving attention to the elements of an image data processing and analysis system, geometric corrections, image enhancement and filtering processes, feature extraction and classification, the image signal in spatial and frequency domain, and a numerical example for texture-context features. G.R.

A76-34017 # Possibility of using orthonormalized polynomials in magnetic cartography (O vozmozhnosti ispol'zovaniia ortonormirovannykh polinomov v magnitnoi kartografii). V. I. Kolesova (Akademiia Nauk SSSR, Institut Zemnogo Magnetizma, Ionosfery i Rasprostraneniia Radiovoln, Leningrad, USSR). *Geomagnetizm i Aeronomiia*, vol. 16, Mar.-Apr. 1976, p. 386-389. In Russian.

A76-34286 * Solar energy microclimate as determined from satellite observations. T. H. Vonder Haar and J. S. Ellis (Colorado State University, Fort Collins, Colo.). In: Optics in solar energy utilization; Proceedings of the Seminar, San Diego, Calif., August 21, 22, 1975. Palos Verdes Estates, Calif., Society of Photo-Optical Instrumentation Engineers, 1975, p. 18-22. 7 refs. Contract No. NAS5-22372.

A method is presented for determining solar insolation at the earth's surface using satellite broadband visible radiance and cloud imagery data, along with conventional in situ measurements. Conventional measurements are used to both tune satellite measurements and to develop empirical relationships between satellite observations and surface solar insolation. Cloudiness is the primary modulator of sunshine. The satellite measurements as applied in this method consider cloudiness both explicitly and implicitly in determining surface solar insolation at space scales smaller than the conventional pyranometer network. (Author)

A76-34571 * # Measurement of auroral Birkeland currents. S. O. Hédili (New Hampshire, University, Durham, N.H.). *Journal of Geomagnetism and Geoelectricity*, vol. 27, no. 6, 1975, p. 505-510. 8 refs. Grants No. NGR-30-002-008; No. NSG-624.

Results are presented for measurements of the auroral current made with a rocket-borne experiment over Fort Churchill, Canada, during the February-May period in 1968. On the upward leg of the rocket flight there were detected a westward auroral current of 10,000 A near 96 km altitude and two oppositely directed Birkeland

currents of about 0.00005 A per sq m at about 160 km altitude. On the downward leg there were revealed a westward filament of current of about 0.0008 A per sq m at about 220 km altitude, two oppositely directed Birkeland sheet currents of about 0.00014 A per sq m at about 230 km altitude, and two oppositely directed Birkeland currents of about 0.00007 A per sq m which fed a westward auroral electrojet of about 0.0010 A per sq m at about 100 km altitude and were associated with a bright rayed arc. A reversal in the Birkeland current system near midnight was also observed. These observations are probably manifestations of the complex nature of small-scale currents associated with complicated auroral forms. S.D.

A76-34633 # Determining geostrophic winds using a satellite-borne infra-red radiometer. G. D. Alexander (U.S. Army, White Sands Missile Range, N. Mex.). *Weather*, vol. 31, June 1976, p. 191-195. 13 refs.

Several possible approaches for calculating the geostrophic wind field from satellite IR data are examined, along with a comparison between geostrophic and actual winds. Vertical temperature profile method and statistical techniques are outlined. It is shown that satellite-borne IR radiometers specifically designed to sound the atmospheric thermal structure can yield useful estimates of the wind field for much of the atmosphere. The horizontal scale will be limited by the ability of the radiometers to respond accurately to horizontal temperature gradients in the atmosphere and the horizontal resolution of the radiometer itself. In addition, clouds in the field of view of the radiometer preclude obtaining accurate data for calculating geostrophic winds from some distance above the cloud to the surface. IR radiometers with a better resolution are expected to yield improved results for more of the atmosphere. S.D.

A76-34663 * Remote monitoring of environmental particulate pollution - A problem in inversion of first-kind integral equations. A. L. Fymat (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Applied Mathematics and Computation*, vol. 1, no. 1, 1975, p. 131-185. 58 refs. Contract No. NAS7-100.

The determination of the microstructure, chemical nature, and dynamical evolution of scattering particulates in the atmosphere is considered. A description is given of indirect sampling techniques which can circumvent most of the difficulties associated with direct sampling techniques, taking into account methods based on scattering, extinction, and diffraction of an incident light beam. Approaches for reconstructing the particulate size distribution from the direct and the scattered radiation are discussed. A new method is proposed for determining the chemical composition of the particulates and attention is given to the relevance of methods of solution involving first kind Fredholm integral equations. G.R.

A76-34721 # An experiment in the application of space information for the conservation of nature and rational use of natural resources (Opyt primeneniia kosmicheskoi informatsii dlia tselei okhrany prirody i ratsional'nogo ispol'zovaniia prirodnykh resursov). S. V. Skatershchikov. *Geodeziia i Kartografiia*, Apr. 1976, p. 39-44. 11 refs. In Russian.

A land-use classification scheme is presented and applied to satellite imagery of the Crimean peninsula at scales of 1:1,000,000 and 1:500,000. The results are used to assess the extent of anthropogenic alteration of the landscape. Arid and irrigated regions are clearly distinguishable. Forests can be identified as broadleaf or evergreen; however, individual tree species cannot be discriminated. Land use maps revealing the extent to which anthropogenic alteration of natural features has occurred can be used to plan conservation and rational exploitation of natural resources. C.K.D.

A76-34934 * The nature of multiple solutions for surface wind speed over the oceans from scatterometer measurements. J. C. Price (NASA, Goddard Space Flight Center, Atmospheric and Hydrospheric Applications Div., Greenbelt, Md.). *Remote Sensing of Environment*, vol. 5, no. 1, 1976, p. 47-54.

The satellite SEASAT-A will carry a radar scatterometer in order to measure microwave backscatter from the sea surface. From pairs of radar measurements at angles separated by 90 deg in azimuth the surface wind speed and direction may be inferred, though not uniquely. In this paper the character of the solutions for wind speed and direction is displayed, as well as the nature of the ambiguities of these solutions. An economical procedure for handling such data is described, plus a criterion for the need for conventional (surface) data in order to resolve the ambiguities of solutions. (Author)

A76-35001 * International Symposium on Remote Sensing of Environment, 10th, University of Michigan, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volumes 1 & 2. Symposium sponsored by the Environmental Research Institute of Michigan, University of Michigan, NASA, et al. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975. Vol. 1, 719 p.; vol. 2, 835 p. Price of two volumes, \$45.

Topics treated include the application of a Fourier transform spectrometer to infrared remote sensing, the performance optimization of a satellite-borne thematic mapper, a data handling system to be integrated with a digital airborne multispectral scanner, infrared thermography for micro- and mesometeorological measurements, satellite interrogated data collection platforms for river and flood forecasting and the automatic measurement of sea surface temperature from a GOES satellite. Solar and atmospheric effects on satellite imagery derived from aircraft reflectance measurements, methods for determining haze levels from multispectral scanner data, restoration of Landsat images by discrete two-dimensional deconvolution and the automatic classification of aircraft and satellite multispectral images using mixed integer programming are also discussed.

B.J.

A76-35007 # Measurement of infrared emission signatures and their application to remote sensing. R. J. Brown, R. G. Apps, and B. G. Young (Defence Research Establishment, Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 77-84.

Results using the Fourier transform spectrometer fitted with a HgCdTe detector indicate that division of the 8 to 13 micron spectral band into narrower spectral channels may be advantageous for some remote sensing operations. The emissivity of crushed fused quartz with the well known emissivity dip attributed to the silicate stretching mode was studied. The emissivities of red and clear lacquer and white, green, and yellow paint were studied in order to determine what effects pigments have on emissivity, what variations exist between different types of paints (latex, alkyd, gloss enamels) and the effects of weathering on the spectral signatures. B.J.

A76-35010 # Micro and mesometeorological information by means of remote sensing techniques. S. Lindqvist (Goteborg, Universitet, Goteborg, Sweden) and J. O. Mattsson (Lund, Universitet, Lund, Sweden). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 123-130. 14 refs.

Experiments involving airborne and ground-based infrared thermography of the earth surface for the purpose of detecting heat islands, ice formation on roads, etc., are described. Nighttime aerial photography for the purpose of studying precipitation, detecting fog and frost, and providing data on local and microclimates is examined. Error sources associated with retroreflective recording using airborne lasers or cameras for dew surveying are enumerated. The study of cloud formation in coastal areas using Landsat-1 imagery is discussed. B.J.

A76-35016 # Remote sensing for global atmospheric research program. E. S. Epstein (NOAA, Rockville, Md.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 183-186.

The paper discusses remote sensing platforms and techniques from satellites, aircraft, balloons, buoys and the earth surface used in the recently concluded field phase of the first GARP Atlantic Tropical Experiment and under consideration for the first GARP Global Experiment to be undertaken in 1977-1979. The Vertical Temperature Profile Radiometer of the NOAA-2 and 3 satellites was used for measurement of vertical temperature and sea surface temperature. Other satellites were used to measure horizontal wind fields, cloud cover, and precipitation. Ships were used to monitor precipitation, atmospheric turbulence, and internal ocean waves. Aircraft were used to determine sea surface temperature, ocean wave profiles, and rainfall intensity. The future use of Seasat-A in GARP is discussed.

B.J.

A76-35017 # Addressing the remote sensing 'data-information gap' - Overhead monitoring in New York's St. Lawrence River-Eastern Lake Ontario coastal zone. T. M. Lillesand (New York, State University, Syracuse, N.Y.) and W. E. Tyson (St. Lawrence-Eastern Ontario Commission, Watertown, N.Y.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 189-201. 11 refs.

A76-35018 # Remote sensing of luminescing environmental pollutants using a Fraunhofer Line Discriminator /FLD/. R. D. Watson (U.S. Geological Survey, Flagstaff, Ariz.), W. R. Hemphill (U.S. Geological Survey, Washington, D.C.), and R. C. Bigelow (U.S. Geological Survey, Denver, Colo.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 203-222. 15 refs.

A redesigned Fraunhofer Line Discriminator (FLD) tested in both ground-based and airborne experiments for 18 months (1974-75) to determine its ability to detect luminescing pollutants, has demonstrated the capability of operating at selected Fraunhofer wavelengths throughout the visible spectrum, with a sensitivity sufficient to detect 0.25 parts per billion rhodamine WT dye in 0.5 m depth of water at 20 C. The instrument has been used to detect and monitor several sources of pollution including oil spills and seeps, sewage effluent, phosphate processing effluent, and paper mill effluent. Selected luminescent dyes that could be used as tracers in pollutant transport studies were monitored in real time from helicopter platform. A comparison of laboratory measurements used to predict the detectivity of a given pollutant and actual field measurements with the FLD demonstrates that the laboratory technique can be used reliably to predict the detectivity of these materials in the field with the FLD.

(Author)

A76-35019 # Detection and analysis for water surface covered with oil film. M. Matsui, S. Tsutsumi (Kyoto Institute of Technology, Matsugasaki, Japan), and T. Takagi (Fukuyama University, Fukuyama, Hiroshima, Japan). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 223-230.

The additive background radiation from all materials other than the targets to be detected presents a serious problem to the passive infrared sensors. This report describes both the scanning angle dependence of the spatial radiance distribution over the sea surface

and the relationship of the sea surface radiance versus the thickness of oil film by which the sea surface is covered uniformly, operating in the spectral region of 10 to 13 microns.

(Author)

A76-35020 # A new concept for the remote measurement of oil fluorescence conversion efficiency. R. T. V. Kung and I. Itzkan (Avco Everett Research Laboratory, Inc., Everett, Mass.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 231-241. 6 refs.

A method is proposed for the absolute remote measurement of oil fluorescence conversion efficiency during the remote monitoring of oil spills from an aircraft using a laser as an excitation source. The method employs the integrated water Raman return as a reference that is calibrated by the measurement of the temporal Raman decay constant without prior knowledge of the oil film thickness. The oil fluorescence conversion efficiency is a good identifier of oil types since it spans over three orders of magnitude from heavy residual to light oils. To achieve a factor of two accuracy, the film thickness should be greater than 0.5 micron, the optical depth of film should be above 0.05, the sea water attenuation coefficient should be less than 1.0/m, and background sea water fluorescence efficiency should be less than the equivalent thick film oil fluorescence conversion efficiency. An example of two oils is provided.

S.D.

A76-35021 # Radar observations of controlled oilspills. J. van Kuilenburg (Netherlands Interdepartmental Working Community for the Application of Remote Sensing Techniques, Delft, Netherlands). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 243-250. 11 refs.

A report is given of studies and experiments concerning the radar detection of oilspills at the seasurface. From scatterometer observations of oilspills in a wavetank it is concluded that oil is always detectable, but also that oil-type and thickness are of little influence on the radarecho. The radar observation of the damping of water waves which travel into the polluted area is proposed as an indicator of the physical oil properties. A radar operating in the VV-polarization mode is shown to be optimal because of the strength of the radarecho, the observed contrast and the low noise. However, experiments using a SLAR operating in the HH-mode, showed this polarization combination to perform well enough for the purpose of oil detection. In general the conclusion is drawn that the SLAR performs well for detection and mapping of oilspills but that other sensors are needed for classification and quantification of oilspills.

(Author)

A76-35022 * # Satellite global monitoring of environmental quality. R. A. Schiffer (NASA, Office of Applications, Washington, D.C.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 255-263.

The missions of two NASA satellites for the monitoring of environmental quality are described: Nimbus G, the Air Pollution and Oceanographic Observing Satellite, and the Applications Explorer Mission (AEM) satellite to be used in the Stratospheric Aerosol and Gas Experiment (SAGE). The scientific payload of Nimbus G is described in detail with a discussion of limb infrared monitoring of the stratosphere, the stratospheric and mesospheric sounder, stratospheric aerosol measurement, the solar and backscatter UV spectrometer for ozone mapping, the earth radiation budget experiment, the scanning multichannel microwave radiometer, the coastal zone color scanner and the temperature-humidity infrared radiometer. A brief description is given of the SAGE program and future NASA plans relating to the global monitoring of environmental quality are outlined.

B.J.

A76-35023 # Degradation of the vegetation cover with urbanization and its influence on the flow of polluted air. I. Nakajima (Ministry of Agriculture and Forestry, Tokyo, Japan). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 275-282. Research supported by the Science and Technology Agency and Japan Computer Usage Development Institute.

Types of surface structure are determined from satellite data on light waves reflected from the earth's surface in the 0.5-0.6, 0.7-0.8, and 0.8-1.0 micron wavelength bands. On the basis of positive and negative images obtained for each wavelength band by Landsat, the print method is used to compile a surface structure imagery in which different colors are used to identify six types of surface covering: forest; grassland, farmland, and green belts; residential land; bare land; highly urbanized land; and water. Particular attention is given to the degradation of vegetation cover with urbanization, related atmospheric pollution, and decrease in green cover and increase in thermal surface radiation. Excessive exploitation of land and resultant destruction of surface vegetation have resulted in concentration of polluted air and photochemical smog over densely populated areas. Future urban planning should allocate between 25 and 30% of land area for vegetation. S.D.

A76-35024 # Measurements of vegetation stress by a multispectral scanner as a basis for air quality maps. H. Marschalek (SPACETEC GmbH, Vienna, Austria). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 283-291. 5 refs.

The tree proves suitable as an indicator of the influence of pollution in a forest area and in areas with a sufficient number of forest plantations. The major advantage of a multispectral scanner (MSS) over the infrared false color film is the access to the information stored on a magnetic tape, electronic data processing, objective-scaled reproduction of reflected radiation, and rapid reception of the images pertaining to the condition of the trees. The elaboration of a specific map of air pollution effect is discussed in terms of principles of interpretation, interpretation process, and first results obtained. Other topics discussed include separation of tree species, determination of tree age, interpretation code for test plants, and other applications. An MSS appears to be important not only because of the definition of the damage in forest plantations, but also because it allows separation of different classes from each other. S.D.

A76-35026 # Space remote sensing of smokes. A. A. Grigor'ev and V. B. Lipatov (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 305-318. 6 refs.

Numerous observations of fire smoke on space imagery show that contribution of smoke to atmospheric pollution is larger than would be expected from routine observations. Particular attention is given to the localization of sites for fire origin from TV pictures taken from meteorological satellites and to a study of the macroscale and mesoscale circulation from smoke clouds. Results are presented for an experiment on the quantitative estimation of smoke charge. It is shown that space photographs can be used to detect smoke cloud and smoke haze, to obtain data on size and distribution, to estimate smoke pollution thickness, to secure information on the macroscale and mesoscale circulation of air streams, and to assess the effect of the underlying surface on the development of fire. In particular, space remote sensing of smoke proves useful in localizing the area of fire occurrence and in estimating the regional and global atmospheric pollution due to smoke. S.D.

A76-35027 # Formation of reflection spectrum of the earth near the boundary dividing two uniform surfaces. A. A. Buzhikov, K. Ia. Kondrat'ev, and O. I. Smoktyi (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 319-325. 8 refs.

Essential to the analysis of spaceborne spectrophotometric data on the reflection spectrum formed on the interface of two uniform media on the earth surface is a clear-cut fixation of the object-background interface and the determination of the linear dimensions of the region of optical nonuniformity for each wavelength measured. This problem is solved using the example of analysis of data obtained from Soyuz-9 spectrophotometric measurements of the reflection spectrum of the interface of sand seashore and sea surface at Cape Bekdash on the Caspian Sea. This example shows that in spaceborne spectrophotometry of the nonuniform underlying surface formed by two uniform half planes, the transition from spectral brightness of the half plane with the larger albedo to the brightness of the half plane with the smaller albedo occurs via a transient region of definite linear dimensions. B.J.

A76-35028 # Solar occultation measurements of the water vapor mixing ratio in the stratosphere and mesosphere from the 'Salyut-4' orbital station. K. Ia. Kondrat'ev, A. A. Buzhikov, G. M. Grechko, A. A. Gubarev, and A. G. Pokrovskii (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 327-332. 27 refs.

The results of solar occultation measurements of the water vapor mixing ratio in the stratosphere and mesosphere performed in January 1975 over Marshall Islands with the spectrometer installed on the Salyut-4 orbital station are discussed. The solar occultation measurements were performed at sunrise. An IR spectrometer with the channel range of 3800-3825/cm and spectral resolution of 0.8/cm was used. The results obtained revealed the presence of a 'dry' stratosphere with the mixing ratio of about .000001 over Marshall Islands at the time of the experiment. (Author)

A76-35030 # Great Lakes environmental land use mapping. C. Risley, Jr. (U.S. Environmental Protection Agency, Office of Research and Development, Chicago, Ill.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 337-343.

The tasks, procedures used, and preliminary results of a Canadian/American project for environmental land use mapping of the Great Lakes are discussed. The project uses ERTS imagery and advanced computer technology to produce the desired land use inventory. The U.S. portion of the Great Lakes Basin comprises portions of eight states and contains 191 counties. Computer-implemented analysis of MSS data is used to derive spectrally separable classes related to the land use classes. Final results of the land use inventory will be reported in the form of maps and tables. S.D.

A76-35031 # Evaluation of land use and its color representation in Tokyo districts with Landsat digital data. S. Murai (Tokyo University, Tokyo, Japan). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 345-350.

A color index is suggested for determining land use from satellite imagery. Water, vegetation, and nonorganic matter are associated with the colors blue, green, and red, respectively. In the case of Landsat data, color representations are obtained from multispectral scanner bands 5 and 7 by means of a color printer with

eight bit levels of exposure. Water surfaces are characterized by MSS 7 less than two. The value for the green file is kept constant for water surfaces regardless of the magnitude of MSS 7, and the value for the blue file is increased with increasing MSS 5 values. In the case of land surfaces, the value for the blue file is inversely related to the MSS 5 value, and the value for the green file increases with increasing MSS 7. The red file increases with increasing MSS 5. The color index has been used for the interpretation of Landsat imagery of the Tokyo and Chiba districts in Japan. C.K.D.

A76-35033 # Utilization of high altitude photography and Landsat-1 data for change detection and sensitive area analysis. S. D. De Gloria, S. J. Daus, N. Tosta, and K. Bonner (California, University, Berkeley, Calif.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 359-368. 5 refs.

A multidisciplinary and multipurpose remote sensing study was conducted in the northern desert shrub environment to evaluate the applicability of remotely-sensed data as an input to the Bureau of Land Management (BLM) Planning System, and to provide map products and data summaries to be utilized by District-level land managers. The experimental design, procedures, and results of the environmental monitoring tasks of that study are reported. Sensitive areas were mapped and monitored within and between two seasons utilizing both manual and automatic analyses of high-altitude CIR photography and Landsat-1 data. Photographic illustrations, photo and base map overlays, and digital output were generated for a 500,000 hectare region in northeastern California and northwestern Nevada. (Author)

A76-35035 # Landsat investigations of recent urban land use changes in Northeast China. R. Welch and C. W. Pannell (Georgia, University, Athens, Ga.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 373-382. 11 refs. Research supported by the University of Georgia.

Information on land use changes in four Chinese cities, Shenyang, Anshan, Fushun and Changchun, for the period 1945-73, was obtained by comparing Landsat images with maps and aerial photographs produced at the end of World War II. Both visual interpretation of images and machine processing of computer compatible tapes were employed to analyze the Landsat data. Of the two techniques, the visual approach was considered to be superior in terms of accuracy, time and cost. Comparative studies of available data indicate all cities underwent extensive growth and change during the study period. The predominant pattern of growth and change seems to involve a shift from the functionally distinct urban sectors originally developed by the Japanese to a mixture of housing estates, administrative buildings and industrial sites. These changes are thought to be consistent with contemporary Chinese planning policies of creating self-contained urban communities. (Author)

A76-35036 # A national land use survey of the developed areas of England and Wales by remote sensing. J. L. van Genderen (Fairey Surveys, Ltd., Maidenhead, Berks.; Sheffield, University, Sheffield, England) and T. F. Smith (Department of the Environment, London, England). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 383-392. 16 refs.

A land use inventory of developed areas of five hectares and larger is under way. Panchromatic vertical air photographs are being used in conjunction with census data to construct land use maps at a

scale of 1:50,000. The imagery is interpreted visually to place land in one of five use categories (predominantly residential; predominantly industrial or commercial; predominantly educational or community use; transport use; urban open space) with the help of scanning mirror spectroscopes with 4.5x magnification and a double scanning zoom stereoscope with up to 15x magnification. Information is placed on the transparent map overlay primarily by visual cross transfer. Each area of land use will be assigned a 14 digit code, and the digitized data will be used to calculate national totals in each land use category. Coordinate references of boundaries of land areas will be stored on magnetic tape. C.K.D.

A76-35048 # A time to choose. J. Y. Cousteau (Cousteau Society, Inc., Westport, Conn.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 505-509.

An appeal is made for international cooperation in the monitoring and protection of the world's oceans. The probable consequences of the extinction of life in the Black Sea and Mediterranean are discussed. The effects of changing attitudes and values of the scientific community on progress in the development of measures for preventing pollution of the oceans and of techniques for investigating the ocean environment are considered. The differing priorities of developing and developed countries and their impact on the potential for international cooperation in the preservation of the oceans are examined. C.K.D.

A76-35049 # Finland's approach to remote sensing oriented earth resources surveys. S. Jaakkola and E. Kilpela (Technical Research Center of Finland, Espoo, Finland). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 511-520.

In the beginning of 1974, a three-year Earth Resources Remote Sensing Project was initiated at the Laboratory of Land Use, Technical Research Center of Finland. The ultimate objective of the project is to develop automated environment monitoring and resource inventory methods capable of meeting Finnish needs and conditions. On the basis of various promising preliminary results obtained by modern remote sensing techniques, especially in the U.S., it seems justified and necessary to perform closer analyses on the practical uses of these techniques. This requirement arises, in Finland particularly, in the fields of forestry, geology and hydrology. These are the three branches involved in laboratory's multidisciplinary R&D effort. In addition to digital satellite data, the project also operates with digital aircraft scanner data. The approach to data processing is largely software-oriented. (Author)

A76-35066 # Signature variations due to atmospheric effects. R. E. Turner (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 671-682.

In the analysis of multispectral remote sensing data it has been noticed that there is an influence of background on target as a result of scattering by the atmosphere. If this effect is strong, then the spectral signature of a class of materials will depend upon the surface spatial pattern, the reflectances of the materials composing the background, the atmospheric state, and the geometric conditions such as sun angle and view angle. The effect of neglecting the background interference is similar to the effect of including a high degree of atmospheric spatial inhomogeneity throughout the scene. To solve the problem, a single-scattering solution of the radiative transfer equation for a point source was obtained and that solution was integrated over a surface spatial pattern characteristic of natural

agricultural materials. The results of the calculations show the change in signal level for specific targets using Landsat channels with a variety of background materials. (Author)

A76-35067 * # Solar and atmospheric effects on satellite imagery derived from aircraft reflectance measurements. R. W. Dana (U.S. Department of Agriculture, Forest Service, Berkeley, Calif.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 683-694. 12 refs. NASA Order T-4106-B.

Solar and atmospheric effects on satellite imagery were investigated by measuring terrain reflectance from low-flying aircraft. Radiometric data were recorded over three test sites in California, Georgia, and South Dakota. Radiance from Skylab (EREP) S190A and ERTS-1 (Landsat-1) sensors was linearly correlated with wide-band terrain reflectance. The results support the proposition that the coefficients of the regression equation are the path radiance and a quantity representing the product of total irradiance and beam transmittance at the time of satellite overflight. These coefficients should be useful as linear conversion coefficients for extending spectral signatures in computer-aided classification work on satellite imagery. (Author)

A76-35068 * # On the determination of haze levels from Landsat data. J. F. Potter and M. A. Mendlowitz (Lockheed Electronics Co., Inc., Houston, Tex.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 695-703. 6 refs. Contract No. NAS9-12200.

The paper describes two methods for determining haze levels (specified by haze optical depth at a wavelength of 0.5 microns) from Landsat multispectral scanner data. The channel correlation method relates the haze level to the y-intercept of the regression line through a plot of the data in the plane of the multispectral channels MSS 4 and MSS 5. The minimum value method relates haze level to the minimum value of individual lines in the MSS 4 data set. B.J.

A76-35069 # Preprocessing algorithms for the use of radiometric corrections and texture/spatial features in automatic land use classification. J. H. Herzog and B. Sturm (EURATOM and Comitato Nazionale per l'Energia Nucleare, Centro Comune di Ricerche, Ispra, Italy). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 705-724. 20 refs.

Two preprocessing techniques have been applied to data generated by the NASA Landsat 1 satellite over the pre alpine region of Northern Italy. In the first technique a transformation has successfully been applied to Landsat data to relate count rate to reflectance. The results have allowed a simple ratio classifier developed for earth based measurements to be applied to satellite data. In the second technique textural measurements have been applied to space data to identify mixed picture elements (mixels). The mixel is the inevitable result of the spatial quantization of low resolution images. Pixels which vary greatly from their neighbors have a higher priority of being mixels than pixels which are similar to their neighbors. Mixels are shown to be representative of types of land use involving high texture. Texture measurements are useful in determining land usage. By screening data to eliminate mixels improved results are obtained in test site selection, classification, and cluster analysis. (Author)

A76-35076 * # Optical atmospheric scattering and absorption limitations on offset pointing from Earth Observatory Satellite /EOS/ sensors. W. G. Egan and W. L. Fischbein (Grumman Aerospace Corp., Bethpage, N.Y.). In: International Symposium on Remote

Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 783-792. 10 refs. Contract No. NAS5-20520.

The Braslau-Dave atmospheric model which calculates the upward monochromatic light fluxes leaving the top of the atmosphere as a function of viewing angle, sun angle, and ground reflectance was employed to study the effect of atmospheric scattering and attenuation on universal apparent contrast for two EOS remote sensors operated at very large offset or pointing angles: the Thematic Mapper (TM) and the High Resolution Pointable Imager (HRPI). The TM offset off nadir could be plus or minus 20 degrees with an 11 degree scan angle and the HRPI pointing angle off nadir could be plus or minus 45 degrees with a 3 degree scan angle. The reduction of universal apparent contrast of EOS imagery is studied as a function of sun elevation angle, atmospheric aerosol loading, radiation wavelength and sensor look angles. B.J.

A76-35082 # Survey of recent resource applications in Michigan. W. C. Taylor, W. R. Enslin (Michigan State University, East Lansing, Mich.), C. E. Olson, Jr. (Michigan University, Ann Arbor, Mich.), and I. J. Sattinger (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 857-865. 12 refs.

Applications of remote sensing data, including Landsat and Skylab coverage and aerial color and color-IR photography, to the management of land, water, and wildlife resources in Michigan are discussed. A comprehensive land cover/land use inventory using high-altitude color-IR photography is under way. Aerial photography has been used to determine the optimum location and extent of proposed open spaces and to detect violations of codes and ordinances regarding land development and use. The use of computer-processed multispectral scanning data for monitoring and evaluation of wildlife habitat has given promising results. Mapping of shoreline changes to protect new development in high-risk erosion zones is in progress. Care is taken to ensure close cooperation of remote sensing technical and scientific personnel with the user community. C.K.D.

A76-35083 # Louisiana Comprehensive Planning Information System - Compilation and utilization of the data base. E. L. Schwartz, Jr. (Louisiana State Planning Office; Louisiana State University, Baton Rouge, La.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 873-877. 7 refs.

The development of a computer oriented planning information system, the Comprehensive Planning Information System (CPIS), by the Louisiana State Planning Office is presented. A brief description of the types of sociodemographic data stored in CPIS is covered. Considerable detail is devoted to the Land Use and Data Analysis (LUDA) Program of the U.S. Geological Survey (USGS) as it pertains to a cooperative agreement between the Louisiana State Planning Office and the Geography Program of USGS. Also reported is an account of the successful use made of the computerized land use data when merged with flood delineations obtained from Landsat satellite imagery to provide flood maps and tabulations. Computerization of soils association data for storage in CPIS and the potential for producing thematic soils limitation/suitability maps is presented. Examples of the use of data presently stored on CPIS, as well as projected uses for CPIS data, are listed. (Author)

A76-35084 * # A look at Alaskan resources with Landsat data. J. M. Miller, A. E. Belon, L. D. Gedney, and L. H. Shapiro (Alaska University, Fairbanks, Alaska). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich.,

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October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 879-892. Grant No. NGL-02-001-092.

Landsat data remains a vital tool for the management of resources in Alaska. Utilization of these data by many agencies in Alaska trends toward the solution to operational problems in a wide spectrum of disciplinary applications. Four examples of current applications are reviewed briefly: mapping of coastal sediment plumes, mapping of coastal zone ecosystems, mapping of landform and ground cover for proposed national parks and forests, and evaluation of seismic risks for a proposed hydroelectric project.

(Author)

A76-35085 # Satellite and airplane remote sensing of natural resources in the State of Washington. R. B. Scott and R. A. Harding (Washington State, Dept. of Natural Resources, Olympia, Wash.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 893-900. 6 refs. U.S. Department of the Interior Contract No. 14-08-001-12863.

A76-35087 # Utilization of remote sensing technology in natural resources development in Bangladesh. A. Hossain and M. U. Chaudhury. In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 907-910.

A76-35096 # Geothermal survey using thermal infrared remote sensing in Japan. H. Hase, K. Matsuno, and K. Nishimura (Geological Survey of Japan, Kawasaki, Japan). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 995-1005. 6 refs.

A national survey of geothermal resources was undertaken in Japan in 1972. Aerial thermal infrared remote sensing was used to detect thermally anomalous spots in some portions of the survey area. Imagery obtained at an altitude of 1000 m was useful for the detection of anomalies which could be readily identified at the site. Geothermal spots which were difficult to identify by a field survey could be identified from infrared imagery obtained at an altitude of 600 m. A heat discharge at least 100 times greater than the average conductive heat flow in the crust was necessary for discrimination of an anomalous area from the surrounding thermal pattern. C.K.D.

A76-35108 # The influence of soil moisture on the microwave response from terrain as seen from orbit. R. K. Moore, F. T. Ulaby, and A. Sobti (University of Kansas Center for Research, Inc., Lawrence, Kan.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1141-1147. 7 refs.

Data from the S-193 radiometer/scatterometer on board Skylab were used to determine the influence of soil moisture on the microwave response from terrain. Rainfall data from NOAA weather reporting stations for five days preceding data-take by the radiometer/scatterometer were gridded, and the soil moisture for each S-193 target point was estimated by extrapolation and interpolation. A pass over Texas in June 1973 was analyzed, taking into account the effects of soil permeability and potential and, to a more limited extent, cloud cover. A regression analysis yielded a correlation coefficient for the radiometer temperature and composite rainfall of over -0.80. The correlation coefficient of backscatter with composite rainfall was about 0.60. C.K.D.

A76-35458 # The proton component of the earth radiation belts studied on the basis of Molniya satellite measurements (Protonnaia komponenta radiatsionnykh poiasov zemli po izmereniiam na ISZ 'Molniia'). A. S. Kovtikh, M. I. Panasiuk, and E. N. Sosnovets (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). (Mezhdunarodnyi Seminar po Korpuskuliarnye Potoki Solntsa i Radiatsionnye Poiasa Zemli i Iupitera, 7th, Leningrad, USSR, May 25-28, 1975.) *Akademiia Nauk SSSR, Izvestiia, Seria Fizicheskaiia*, vol. 40, Mar. 1976, p. 496-501. 21 refs. In Russian.

A76-35474 # Amplitude distribution of pulsations of quasi-trapped electrons in the inner magnetosphere (Ob amplitudnom raspredelenii pul'satsii kvazizakhvachennykh elektronov vo vnutrennei magnitosfere). Ia. Kolarzh (Ceske Vysoke Ucení Technické, Prague, Czechoslovakia) and S. Fischer (Ceskoslovenska Akademie Ved, Astronomický Ústav, Ondřejov, Czechoslovakia). (Vsesoiuznaia Konferentsiia po Fizike Kosmicheskikh Luchei, Samarkand, Uzbek SSR, Oct. 29-31, 1975.) *Akademiia Nauk SSSR, Izvestiia, Seria Fizicheskaiia*, vol. 40, Mar. 1976, p. 558-560. 6 refs. In Russian.

A76-35695 * Spectral characteristics of the microwave emission from a wind-driven foam-covered sea. W. J. Webster, Jr., T. T. Wilheit, P. Gloersen (NASA, Goddard Space Flight Center, Greenbelt, Md.), and D. B. Ross (NOAA, Atlantic Oceanographic and Meteorological Laboratories, Miami, Fla.). *Journal of Geophysical Research*, vol. 81, June 20, 1976, p. 3095-3099. 16 refs.

Aircraft observations of the microwave emission from the wind-driven foam-covered Bering Sea substantiate earlier results and show that the combination of surface roughness and white water yields a significant microwave brightness temperature dependence on wind speed over a wide range of microwave wavelengths, with a decreasing dependence for wavelengths above 6 cm. The spectral characteristic of brightness temperature as a function of wind speed is consistent with a foam model in which the bubbles give rise to a cusped surface between the foam and the sea. In the fetch-limited situation the contribution of the wave structure at the surface appears to increase as the foam coverage decreases. Although the data show that the thin streaks are the most important part of the white water signature, there is some evidence for the contribution of whitecaps. S.D.

A76-35811 Microwave radiometric detection of atmospheric internal waves. L. U. Martin and C. I. Beard (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *Geophysical Research Letters*, vol. 3, June 1976, p. 327-330. 7 refs.

Microwave radiometers have recently demonstrated a new capability by detecting internal waves in the atmospheric boundary layer and localizing their altitude. Varying the intersection height of a narrow antenna beam with that of a wide vertically pointing antenna beam allowed determination of the wave altitudes. The ground-based radiometers were located at San Diego where, in an experiment in May-June 1975, the Naval Electronics Laboratory Center provided 'atmospheric-truth' for comparison to the radiometer data obtained by the Naval Research Laboratory. Preliminary results showed cases of correspondence between the signals of the passive radiometers and the active FM-CW radar and acoustic sounder systems. Examples included internal wave trains up to an hour in length. (Author)

A76-35812 * Direct measurements of natural tropospheric levels of OH via an aircraft borne tunable dye laser. D. D. Davis, W. Heaps, and T. McGee (Maryland, University, College Park, Md.). *Geophysical Research Letters*, vol. 3, June 1976, p. 331-333. 12 refs. Research supported by the U.S. Department of Transportation and NASA.

A76-35877 Long-path monitoring - Advanced instrumentation with a tunable diode laser. E. D. Hinkley, R. T. Ku (MIT, Lexington, Mass.), K. W. Nill, and J. F. Butler (Laser Analytics, Inc., Lexington, Mass.). *Applied Optics*, vol. 15, July 1976, p. 1653-1655. 10 refs. Research supported by the U.S. Environmental Protection Agency and NSF.

A widely tunable semiconductor diode laser system is adapted to sequential monitoring of many atmospheric pollutant gases over a long beam path, with a single device connected to a closed-cycle stabilized refrigerator of adjustable temperature. This source is adequate for monitoring any air pollutant whose absorption lines lie within the 9-12 micron interval (where the laser is continuously tunable). IR spectra can be measured with high (Doppler-limited) resolution for line strength calibration and for identifying potential interferences. Monitoring sensitivities for such important pollutants as ammonia, vinyl chloride, and ozone are estimated on the basis of laser spectroscopic measurements. R.D.V.

A76-36267 Measurements of the columnar electron contents of the ionosphere and plasmasphere. K. Davies, R. B. Fritz, and T. B. Gray (NOAA, Space Environment Laboratory, Boulder, Colo.). *Journal of Geophysical Research*, vol. 81, June 1, 1976, p. 2825-2834. 26 refs.

Modulation-phase and Faraday-rotation observations of ATS 6 radio-beacon transmissions have measured the total slant electron content to the satellite and the content up to an altitude of about 2000 km. Monthly median hourly values of the total slant content, the residual plasmaspheric content above 2000 km, and a factor related to the electron profile shape and the earth's magnetic field are reported for July 1974 to April 1975. The slab thickness was calculated by using ionograms and numerical mapping estimates of the geographic variations of foF2. The diurnal and seasonal variations of each measured and calculated parameter are discussed in terms of analytical modes for the electron-density profile shape. Representative models for day and night profiles in the summer, equinoctial, and winter seasons are presented, and their reliability is discussed. (Author)

A76-36313 # Effects of aerosols in determining the temperature of the earth's surface at 11.2 microns by using the satellite data. T. Takashima. *Meteorological Society of Japan, Journal*, vol. 54, Apr. 1976, p. 118-122. 8 refs.

An atmospheric model is developed to study the errors introduced by aerosol absorption and scattering into the satellite-borne measurement of earth surface temperature at a wavelength of 11.2 microns. The model uses a Junge particle size distribution for the aerosols and includes large nadir angles of observation suitable for the VHRR of NOAA-3 and 4 and the VISSR of geostationary meteorological satellites. B.J.

A76-36408 Test of the theory of ozone generation in Los Angeles atmosphere. J. G. Calvert (Ohio State University, Columbus, Ohio). *Environmental Science and Technology*, vol. 10, Mar. 1976, p. 248-256. 22 refs.

Operation No. 33 of the Los Angeles Reactive Pollutant Program (LARPP) gathered data on Nov. 5, 1973 over the Los Angeles Basin to test the suitability of current mechanisms for ozone generation in photochemical smog. Pollutant concentrations were determined from aircraft observations and ground-level pollutant concentrations and ultraviolet intensities were also obtained. LARPP data were used to calculate the rate constant ratio (O3) (NO)/(NO2) and to test two theoretical models of ozone generation. The first model neglects UV attenuation within the polluted layer and reflected light from the surface of Los Angeles, while the second takes account of these factors. B.J.

A76-36413 Distribution of airborne polycyclic aromatic hydrocarbons throughout Los Angeles. R. J. Gordon (Southern California, University, Los Angeles, Calif.). *Environmental Science and Technology*, vol. 10, Apr. 1976, p. 370-373. 10 refs. Grant No. NIH-N01-CP-535000.

High-volume air samplers were used to collect samples of airborne particulate matter on an intermittent schedule at 39 locations throughout Los Angeles County for a full year. Composites were extracted and analyzed for 14 polycyclic aromatic hydrocarbons (PAH). Major PAH show high negative seasonal correlations with median early morning atmospheric inversion heights. PAH are highest during the November-January quarter, but ranges for different PAH vary by factors 4-10 during the year. Comparison of relative PAH concentration patterns for different areas suggests that PAH in the better ventilated coastal areas arise primarily from automobiles, while in the areas farthest inland additional smaller amounts of PAH arise from nonautomobile sources. Benzo(a)pyrene averaged 0.46 ng/cu m, but no composite concentration was higher than 2.0 ng/cu m. (Author)

A76-36454 # Use of cloud-cover satellite information for the quantitative long-term forecast. Sh. A. Musaelian (Glavnoe Upravlenie Gidrometeorologicheskoi Sluzhby SSSR, Gidrometeorologicheskii Nauchno-Issledovatel'skii Tsentr, Moscow, USSR). *COSPAR, Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper*. 17 p.

The influence of the ocean cloud cover on the thermal conditions of the atmosphere above continents is studied on the basis of experimental data (satellite cloudiness observations) obtained during the period from March 1965 through December 1974 for the North Atlantic and the European continent. An asynchronous correlation with large time shifts is shown to exist between the ocean cloudiness and the continental temperature field. The correlations obtained are analyzed and their seasonal aspects are studied. V.P.

A76-36577 Possibilities for determination of N2O and CH4 contents in the atmosphere by interpretation of measurements of the spectral and angular structure of the thermal emission. V. V. Rozanov and Iu. M. Timofeev (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR). (*Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana*, vol. 11, Oct. 1975, p. 1066-1069.) *Academy of Sciences, USSR, Izvestiia, Atmospheric and Oceanic Physics*, vol. 11, May 1976, p. 669-671. 9 refs. Translation. (Previously cited in issue 06, p. 816, Accession no. A76-18413)

A76-36623 Infrared photography as an air pollution surveillance instrument. A. F. Casalnuovo and A. Sawan (Akron Regional Air Pollution Control Agency, Akron, Ohio). *Air Pollution Control Association, Journal*, vol. 26, June 1976, p. 585-587.

The paper summarizes the results of two studies attempting to examine the feasibility of aerial infrared photography for pollution monitoring by the detection of plant damage from pollutants before they are visually identifiable. The first study consisted of infrared photography of a potato crop, blighted by ozone, on a farm in Kent, Ohio. The second study consisted of continuous infrared monitoring of the potato crop on the Kent farm for a ten-week period starting in June 1975. The experiments were judged to be successful, permitting the detection of specific areas of the crops which were severely distressed and in need of immediate attention due to lack of moisture. B.J.

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

A76-36624 Correction of ozone-altitude data and stratospheric-source implications. P. P. Cook (Indianapolis Center for Advanced Research, Indianapolis, Ind.) and R. C. Bourke. *Air Pollution Control Association, Journal*, vol. 26, June 1976, p. 587-589. 6 refs.

Two airborne ozone monitors, an ultraviolet-absorbing and a gas-phase chemiluminescent instrument, were used to measure ozone concentrations from ground level to about 28,000 ft over northwest Indianapolis and were found to agree well. Concentration correction factors, to adjust for pressure changes at various altitudes, were determined and found to be as high as a factor of three or four at the maximum altitude reached. The corrections give credence to the assumption that the stratosphere is a major source of ground level ozone. B.J.

A76-36975 Radar reflectivity of land and sea. M. W. Long (Georgia Institute of Technology, Atlanta, Ga.). Lexington, Mass., D. C. Heath and Co., 1975. 390 p. 322 refs. \$22.95.

Remote sensing by radar is considered along with basic concepts and definitions, polarization and theories of scattering, echo fluctuations, average and median cross sections, and the interdependence of polarization characteristics. The effects of the earth's surface are discussed, taking into account fundamental concepts, the echo from targets that are above a flat smooth earth, effects of surface roughness on forward scattered fields, the echo from targets that are above a physically rough earth, and interference effects on echo from land and sea. G.R.

A76-37188 # Particle size distribution measurement - An evaluation of the Knollenberg optical array probes. A. J. Heymsfield (Meteorology Research, Inc., Altadena, Calif.). *Atmospheric Technology*, Spring 1976, p. 17-24. 8 refs.

The principles of operation and the accuracy of different Knollenberg optical array probes for determining cloud particle size distributions are discussed. A cloud particle passing between the two arms of the optical array probe is imaged by a 1.5 mW helium-neon laser, and is imaged as a shadowgraph onto a linear photodiode array. A flip-flop circuit is triggered when a 50% reduction in the light level occurs. The number of flip-flop circuits triggered is registered in a buffer memory system. Accurate particle spectra measurements are obtained by these devices for raindrops and for clouds containing single plates, aggregates of crystals, and bullet rosettes; in clouds containing columnar ice crystals the number concentrations and sizes are underestimated, and in clouds with dendritic crystals the particles are undersized. C.K.D.

A76-37246 # Some possibilities for determining earth-surface temperature from a satellite using the 8-12 micron window (Nekotorye vozmozhnosti opredeleniia temperatury podstilaiushchei poverkhnosti so sputnika v okne 8-12 mkm). V. M. Ivanov and Iu. A. Savitskii (Akademiia Nauk SSSR, Institut Fiziki Atmosfery, Moscow, USSR). *Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana*, vol. 12, Apr. 1976, p. 433, 434. 7 refs. In Russian.

The paper derives earth-surface temperature values from infrared radiometer data obtained by Cosmos-149 using the 8-12 micron window. Relations for taking account of atmospheric attenuation due to moisture monomer and dimer molecules of water vapor are presented. B.J.

A76-37259 Annual review of earth and planetary sciences. Volume 4. Edited by F. A. Donath (Illinois, University, Urbana, Ill.), F. G. Stehli (Case-Western-Reserve University, Cleveland, Ohio), and G. W. Wetherill (Carnegie Institution of Washington, Washington, D.C.). Palo Alto, Calif., Annual Reviews, Inc., 1976. 484 p. \$17.

A compendium of tutorial review articles on the petrology, magnetism, atmospheres, geochemistry, and structure of the earth and planets of the solar system. Topics covered include: lunar petrology as a key to lunar evolution, meteoritic paleomagnetism; ionospheres and hydrogen escape in the case of Mars, Earth and Venus; planetary magnetic fields; hydrology and limnology; topside ionosphere processes; radar mapping of regional tectonic structure;

argillaceous sediment dewatering, electrolyte diffusion, age determinations by radioactive dating; atmospheric pollutants; forms of permafrost in the present and in the geological record. R.D.V.

A76-37450 Low-level moisture intrusion from infrared imagery. F. C. Parmenter (NOAA, National Environmental Satellite Service, Washington, D.C.). *Monthly Weather Review*, vol. 104, Jan. 1976, p. 100-104.

Sensors on synchronous meteorological satellites (SMS) measure the longwave radiation emitted by clouds and terrestrial surfaces. The SMS-2 IR radiometer makes it possible to monitor the progress of warm and cold air masses. Observations made on June 18, 1975 are discussed. The data show the progress of warm moist air from eastern Texas into New Mexico during the nighttime hours. G.R.

A76-37552 # Calculation of absorbed radiation dosages at earth orbits from the solar flare of August 4, 1972 (Raschet pogloshchennykh doz radiatsii ot solnechnoi vspyski 4 Avgusta 1972 g. na okolozemnykh orbitakh). O. I. Savun and A. I. Sladkova. *Kosmicheskie Issledovaniia*, vol. 14, May-June 1976, p. 470-474. 10 refs. In Russian.

Direct satellite measurements in interplanetary space of the absorbed radiation dosage from the cited solar flare are used to calculate the dosages absorbed by spacecraft in circular earth orbits 300 km in height with angles of inclination equal to 51.5 and 65 deg. The screening effect of the geomagnetic field is taken into account. The integrated radiation dosage from the entire flare over the period between August 4 and 7 is determined to have been about 123 rad (surface dosage) and about 10 rad (depth dosage) for an effective shielding of 3 g/sq cm Al. It is then found that the surface dosage within a spacecraft in the specified earth-orbit was 2.05 rad for a 51.5-deg angle of inclination and 9.1 rad for 65 deg. The dosages at a tissue depth of 5 cm were an order of magnitude lower. It is noted that the depth dosages calculated for a relative radiation biological efficiency of 3 were far lower than the 50-rem 'justified-risk dosages' adopted as a criterion of radiation danger for space flight (2 rem for 51.5 deg, 5 rem for 65 deg). F.G.M.

A76-37671 Airborne Pb, Cd, Zn and Cu concentration by particle size near a Pb smelter. C. R. Dorn, J. O. Pierce, II, P. E. Phillips, and G. R. Chase (Missouri, University, Columbia, Mo.). *Atmospheric Environment*, vol. 10, no. 6, 1976, p. 443-446. 14 refs. U.S. Environmental Protection Agency Contract No. 68-02-0092.

A76-37688 # Bi-directional reflectance data from natural surfaces by using a tethered balloon system. J. F. Hagewood (Du Pont de Nemours and Co., Inc., Raleigh, N.C.) and D. Maples (Louisiana State University, Baton Rouge, La.). *American Institute of Aeronautics and Astronautics, Thermophysics Conference*, 11th, San Diego, Calif., July 14-16, 1976, Paper 76-442. 9 p. 11 refs.

A technique was developed to obtain bi-directional reflectance data from natural surfaces by using a folding mirror to transfer the reflected energy from the test surface to a spectroradiometer. The optically folding mirror was positioned over the test surfaces with a movable platform for both laboratory and field tests. Field tests were also conducted using a tethered balloon system to position the folding mirror. A spectroradiometer was designed and built specifically for this investigation. The radiometer was capable of detecting energies in small bandwidths throughout the electromagnetic spectrum from 0.3 microns to 3.0 microns. Bi-directional reflectance data and variations in the data with source angles were obtained for Bermuda grass and a black alluvium soil from the Mississippi River Delta. (Author)

A76-37771 # Considerations concerning an earth survey from outer space (Betrachtungen zur Erderkundung aus dem kosmischen Raum). K.-H. Neumann. *Astronomie und Raumfahrt*, no. 3, 1976, p. 78-83. In German.

Areas of applications for satellite remote sensing studies and the sensors used in these studies are considered, taking into account geodesy, geography, geology, glaciology, hydrology, agriculture, forestry, oceanology, and environmental surveillance. The required accuracy of the data is examined and studies related to a survey of earth resources are discussed. Problems related to the processing of the obtained data are also investigated and a description is given of the spacecraft employed for the earth survey investigations. G.R.

A76-37805 * The use of remote sensing imagery for environmental land use and flood hazard mapping. D. A. Mouat, D. A. Miller, and K. E. Foster (Arizona, University, Tucson, Ariz.). *Journal of Environmental Sciences*, vol. 19, May-June 1976, p. 19-26. 11 refs. NASA-supported research.

Flood hazard maps have been constructed for Graham, Yuma, and Yavapai Counties in Arizona using remote sensing techniques. Watershed maps of priority areas were selected on the basis of their interest to the county planning staff and represented areas of imminent or ongoing development and those known to be subject to inundation by storm runoff. Landsat color infrared imagery at scales of 1:1,000,000, 1:500,000, and 1:250,000 was used together with high-altitude aerial photography at scales of 1:120,000 and 1:60,000 to determine drainage patterns and erosional features, soil type, and the extent and type of ground cover. The satellite imagery was used in the form of 70 mm chips for enhancement in a color additive viewer and in all available enlargement modes. Field checking served as the main backup to the interpretations. Areas with high susceptibility to flooding were determined with a high level of confidence from the remotely sensed imagery. C.K.D.

A76-38017 # Photographic experiments on board manned spacecraft and orbital bases aimed at studying natural resources (Fotograficheskie eksperimenty s pilotiruemykh kosmicheskikh korabli i orbital'nykh stantsii v interesakh izucheniia prirodnnykh resursov). V. D. Bol'shakov and N. P. Lavrova (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR). *Geodeziia i Aerofotos'emka*, no. 6, 1975, p. 59-63. In Russian.

A76-38117 # Remote sensing and Canada Geographic Information System /CGIS/ for impact studies. D. M. Gierman, W. A. Switzer (Environment Canada, Ottawa, Canada), R. A. Ryerson (Canada Centre for Remote Sensing, Ottawa, Canada), and G. Moran (Ecolcon Canada, Ltd., Belleville, Ontario, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 235-241. Research supported by the Department of the Environment.

Utilization of remote sensing techniques in environmental impact monitoring and land use mapping in combination with the Canada Geographic Information System (CGIS) for overlaying information on land use and ecological impact is described. A land use inventory project for the Great Lakes area, probing pollution of boundary waters of the Great Lakes system by agricultural, forestry, and miscellaneous land use practices, is discussed by way of illustration in depth. Land use classification and data handling procedures are discussed, as well as methods of data updating. The method is recommended for application to any other problems where overlay polygons can be employed, such as: inventory of natural vegetation, crop census, routing of pipelines or transportation corridors, and agricultural land capability studies. R.D.V.

A76-38133 # Transformation of radiances into reflectances for water quality studies (Sur la transformation des radiances en réflectances pour l'étude de la qualité de l'eau). G. Rochon (Université Laval, Quebec, Canada) and E. J. Langham (Québec, Université, Quebec, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 393-403. 10 refs. In French.

Landsat data are received as measures of radiance (in mW/sq cm). As such, the data include information on the optical state of the

atmosphere at the time of satellite overflight and have to be reduced to nondimensional reflectance values referable to the observed target alone. Two experimental techniques of data conversion are tested in a study of the St. Lawrence waterway, one based on statistical analysis of a large number of oligotrophic lakes, the other based on linearity of water reflectivity and low suspended solids concentrations. R.D.V.

N76-22621*# Oregon State Univ., Corvallis. **SMALL SCALE PHOTO PROBABILITY SAMPLING AND VEGETATION CLASSIFICATION IN SOUTHEAST ARIZONA AS AN ECOLOGICAL BASE FOR RESOURCE INVENTORY** Ph.D. Thesis

James Russell Johnson, Principal Investigator 17 May 1974 205 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (E76-10301; NASA-CR-146794) Avail: NTIS HC \$7.75 CSCL 08F

The author has identified the following significant results. The broad scale vegetation classification was developed for a 3,200 sq mile area in southeastern Arizona. The 31 vegetation types were derived from association tables which contained information taken at about 500 ground sites. The classification provided an information base that was suitable for use with small scale photography. A procedure was developed and tested for objectively comparing photo images. The procedure consisted of two parts, image groupability testing and image complexity testing. The Apollo and ERTS photos were compared for relative suitability as first stage stratification bases in two stage proportional probability sampling. High altitude photography was used in common at the second stage.

N76-22622*# Kentucky Dept. of Natural Resources and Environmental Protection, Frankfort. **[ENVIRONMENTAL EFFECTS OF STRIP MINING] Quarterly Progress Report, 21 May - 21 Aug. 1975**

Birney R. Fish, Principal Investigator 21 Aug. 1975 3 p Sponsored by NASA ERTS (E76-10303; NASA-CR-146808; QPR-2) Avail: NTIS HC \$3.50 CSCL 08I

N76-22626*# Tri-State Regional Planning Commission, New York.

INVESTIGATION OF SKYLAB IMAGERY FOR REGIONAL PLANNING Final Report

William Harting, Principal Investigator Dec. 1975 39 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP (Contract NAS9-13266) (E76-10308; NASA-CR-147562) Avail: NTIS HC \$4.00 CSCL 05A

The author has identified the following significant results. It is feasible to use earth terrain camera imagery to detect four land uses (vacant land, developed land, streets, and water) for general regional planning purposes. Multispectral imagery is suitable for detecting, mapping, and measuring water bodies as small as two acres. Sufficient information can be extracted to prepare graphic and pictorial representations of the general growth and development patterns, but cannot be incorporated into an inventory file for predictive models.

N76-22627*# Minnesota State Planning Agency, St. Paul. **ANALYSIS OF DATA FOR LANDSAT (ERTS) FOLLOW-ON Progress Report, 26 Dec. 1975 - 25 Mar. 1976**

Joseph E. Sizer, Principal Investigator 16 Apr. 1976 10 p ERTS (Contract NAS5-20985) (E76-10309; NASA-CR-146559) Avail: NTIS HC \$3.50 CSCL 05B

N76-22635*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

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LANDSAT DATA FOR STATE PLANNING Annual Technical Report

N. L. Faust and G. W. Spann Dec. 1975 57 p refs
(Contract NAS8-30653)

(NASA-CR-144266) Avail: NTIS HC \$4.50 CSCL 08B

The results of an effort to generate and apply automated classification of LANDSAT digital data to state of Georgia problems are presented. This phase centers on an analysis of the usefulness of LANDSAT digital data to provide land-use data for transportation planning. Hall County, Georgia was chosen as a test site because it is part of a seventeen county area for which the Georgia Department of Transportation is currently designing a Transportation Planning Land-Use Simulation Model. The land-cover information derived from this study was compared to several other existing sources of land-use data for Hall County and input into this simulation. The results indicate that there is difficulty comparing LANDSAT derived land-cover information with previous land-use information since the LANDSAT data are acquired on an acre by acre grid basis while all previous land-use surveys for Hall County used land-use data on a parcel basis.

Author

N76-22637* Old Dominion Univ. Research Foundation, Norfolk, Va.

RETRIEVAL OF SURFACE TEMPERATURE BY REMOTE SENSING

S. K. Gupta (Old Dominion Univ.) and S. N. Tiwari (Old Dominion Univ.) Apr. 1976 42 p refs
(Grant NSG-1153)

(NASA-CR-147145; TR-76-1T8) Avail: NTIS HC \$4.00 CSCL 04A

A simple procedure and computer program were developed for retrieving the surface temperature from the measurement of upwelling infrared radiance in a single spectral region in the atmosphere. The program evaluates the total upwelling radiance at any altitude in the region of the CO fundamental band (2070-2220 $1/\text{cm}$) for several values of surface temperature. Actual surface temperature is inferred by interpolation of the measured upwelling radiance between the computed values of radiance for the same altitude. Sensitivity calculations were made to determine the effect of uncertainty in various surface, atmospheric and experimental parameters on the inferred value of surface temperature. It is found that the uncertainties in water vapor concentration and surface emittance are the most important factors affecting the accuracy of the inferred value of surface temperature.

Author

N76-22639* South Dakota State Univ., Brookings. Remote Sensing Institute.

APPLICATION OF REMOTE SENSING TECHNOLOGY TO LAND EVALUATION, PLANNING UTILIZATION OF LAND RESOURCES, AND ASSESSMENT OF WILDLIFE AREAS IN EASTERN SOUTH DAKOTA Semiannual Progress Report, 1 Jul. - 31 Dec. 1975

1975 38 p refs

(Grant NGL-42-003-007)

(NASA-CR-147110; SDSU-RSI-76-02) Avail: NTIS HC \$4.00 CSCL 05A

A soils map for land evaluation in Potter County (Eastern South Dakota) was developed to demonstrate the use of remote sensing technology in the area of diverse parent materials and topography. General land use and soils maps have also been developed for land planning LANDSAT, RB-57 imagery, and USGS photographs are being evaluated for making soils and land use maps. LANDSAT fulfilled the requirements for general land use and a general soils map. RB-57 imagery supplemented by large scale black and white stereo coverage was required to provide the detail needed for the final soils map for land evaluation. Color infrared prints excelled black and white coverage for this soil mapping effort. An identification and classification key for wetland types in the Lake Dakota Plain was developed for June 1975 using color infrared imagery. Wetland types in the region are now being mapped via remote sensing techniques to provide a current inventory for development of mitigation measures.

Author

N76-22719* College of William and Mary, Williamsburg, Va. Physics Dept.

ATLAS OF INFRARED ABSORPTION LINE

Jae H. Park [1976] 31 p refs

(Grant NSG-1203)

(NASA-CR-144976) Avail: NTIS HC \$4.00 CSCL 13B

An atlas of infrared absorption line positions vs. line strengths at 300 K is presented for 13 gases from 500 per cm to 7,000 per cm. The absorption bands for each gas shown in the atlas including sources of data are summarized. This atlas is used for feasibility studies of remote sensing of atmospheric pollutants; for the identification of gases in atmospheric absorption spectra; and for obtaining information on (1) what gases contribute to the energy absorption in the spectral regions and (2) their relative strengths in absorption. Special attention should be given to the scale of line strength. The lines are grouped into intervals of 250 per cm, and only those lines with a strength within 0.0001 of the maximum value are shown in each interval.

Author

N76-22730* European Space Agency, Paris (France).

DETECTION AND MEASUREMENT OF NO, NO2 AND HNO3 WITHIN THE STRATOSPHERE

Jean-Claude Fontanella Dec. 1975 103 p refs Transl. into ENGLISH of 'Detection et Dosage de NO, NO2 et HNO3 dans la Stratosphere'. ONERA, Paris Report ONERA-NT-235, 1974 (ESA-TT-233; ONERA-NT-235) Avail: NTIS HC \$5.50

In 1973, measurements were performed of the concentrations of the oxides of nitrogen NO and NO2 and of nitric acid using balloons and the Concorde aircraft as platforms. The method used was absorption spectrometry in the infrared range (5 to 8 micron), using the sun as a source. The instrumentation consisted of Girard-type grating spectrometer, associated with a solar pointer. The high resolution (0.1/cm) made it possible for the first time to reveal and measure the content of nitric oxide NO. Spectra of nitrogen dioxide and of nitric acid were also recorded. Quantitative interpretation of the spectra obtained is mainly dealt with. Problems related to detection and estimation, by this method, of the minor constituents of the atmosphere are also examined.

Author (ESA)

N76-22829* National Environmental Satellite Service, Washington, D.C.

SATELLITE ACTIVITIES OF NOAA, 1975

Apr. 1976 19 p

(NOAA-S/T-76-2185) Avail: NTIS HC \$3.50

The National Oceanic and Atmospheric Administration (NOAA) was established within the United States Department of Commerce in 1970 to improve man's understanding and increase his uses of the air and water environment. The NOAA carries out these responsibilities by maintaining an operational satellite system; by continuing programs for monitoring and predicting marine resources; by monitoring our marine environment continuously with improved sensors on ships, aircraft, and satellites; by improving our weather observations and forecasts through the use of automated observation stations, improved radar systems, and continued atmospheric research programs; by conducting research in weather modification; and by improving data collection, processing, and dissemination techniques. Six major components of NOAA contribute directly to the aeronautics and space program. These are the National Environmental Satellite Service, the National Ocean Survey, the National Marine Fisheries Service, the National Weather Service, the Environmental Research Laboratories, and the Environmental Data Service.

Author

N76-22861* National Oceanic and Atmospheric Administration, Miami, Fla.

A COMPARISON OF SYNOPTIC AND SKYLAB S193/194 DETERMINATIONS OF OCEAN SURFACE WINDSPEEDS

Duncan Ross, Principal Investigator [1975] 76 p refs EREP (NASA Order T-4644-B)

(E76-10312; NASA-CR-147540) Avail: NTIS HC \$5.00 CSCL 04B

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N76-22892*# Texas Univ., Houston. School of Public Health.

PUBLIC HEALTH APPLICATIONS OF REMOTE SENSING OF VECTOR BORNE AND PARASITIC DISEASES Final Report

[1976] 204 p

(Contract NAS9-12696)

(NASA-CR-147573) Avail: NTIS HC \$7.75 CSCL 06F

Results of an investigation of the potential application of remote sensing to various fields of public health are presented. Specific topics discussed include: detection of snail habitats in connection with the epidemiology of schistosomiasis; the detection of certain Anopheles breeding sites, and location of transient human populations, both in connection with malaria eradication programs; and detection of overwintering population sites for

the primary screwworm (*Cochliomyia americana*). Emphasis was placed on the determination of ground truth data on the biological, chemical, and physical characteristics of ground waters which would or would not support the growth of significant populations of mosquitoes. J.M.S.

N76-23467# Physical Dynamics, Inc., Berkeley, Calif.

RADAR SCATTERING FROM A RANDOM OCEAN SURFACE PERTURBED BY A SURFACE CURRENT Interim Report

John Jarem and Bruce J. West Aug. 1975 73 p refs

(Contract F30602-72-C-0494; ARPA Order 1649)

(AD-A019523; PD-74-057; RADC-TR-75-207) Avail: NTIS CSCL 17/9

The scattering of radar energy from a rough ocean surface is considered using the approximations of physical optics and perturbation theory. The ocean surface is taken to be generated by a random process with zero mean value and a homogeneous covariance function represented by a wavenumber energy spectrum. For slightly rough seas the coherent and incoherent backscatter cross-sections are obtained for a general ocean spectrum. For very rough seas, the physical optics cross-sections were calculated for a Gaussian ocean spectrum neglecting shadowing. Scattering from ripples where the ocean surface radius of curvature is no longer large compared to radar wavelength was treated by perturbation theory using the magnetic dyadic Green's function for a half plane. GRA

N76-23642*# Arkansas Univ., Fayetteville. Dept. of Geology. **LAND USE CHANGE DETECTION WITH LANDSAT-2 DATA FOR MONITORING AND PREDICTING REGIONAL WATER QUALITY DEGRADATION Quarterly Progress Report, 28 Jan. - 27 Apr. 1976**

H. C. MacDonald, Principal Investigator and K. F. Steele, May 1976 6 p ERTS

(Contract NAS5-20810)

(E76-10314; NASA-CR-146826) Avail: NTIS HC \$3.50 CSCL 08H

N76-23644*# Federation of Rocky Mountain States, Inc., Denver, Colo.

A REGIONAL LAND USE SURVEY BASED ON REMOTE SENSING AND OTHER DATA Quarterly Report, 10 Jan. - 10 Apr. 1976

George Nez, Principal Investigator 10 Apr. 1976 80 p refs ERTS

(Contract NAS5-22338)

(E76-10317; NASA-CR-147199; QR-4) Avail: NTIS HC \$5.00 CSCL 08B

N76-23645*# West Virginia Dept. of Natural Resources, Charleston.

CONTRIBUTION OF ERTS-B TO NATURAL RESOURCE PROTECTION AND RECREATIONAL DEVELOPMENT IN WEST VIRGINIA Progress Report, 19 Dec. 1975 - 19 Mar. 1976

Ira S. Latimer, Jr., Principal Investigator 19 Mar. 1976 9 p Sponsored by NASA ERTS

(E76-10318; NASA-CR-147200; PR-2) Avail: NTIS HC \$3.50 CSCL 08F

N76-23648*# Geological Survey, Reston, Va.

LAND USE ANALYSIS OF US URBAN AREAS USING HIGH-RESOLUTION IMAGERY FROM SKYLAB

Daniel B. Gallagher, Principal Investigator 10 Sep. 1975 32 p refs Presented at Skylab Earth Resources Experiment Package Regional Planning and Development Conf., Lafayette, Ind., 9-10 Sep. 1975 Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP (NASA Order T-5290-B)

(E76-10321; NASA-CR-147654) Avail: NTIS HC \$4.00 CSCL 02C

The author has identified the following significant results. The S-190B imagery from Skylab 3 permitted the detection of higher levels of land use detail than any satellite imagery previously evaluated using manual interpretation techniques. Resolution approaches that of 1:100,000 scale infrared aircraft photography, especially regarding urban areas. Nonurban areas are less distinct.

N76-23653*# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.

LANDSAT APPLICATION OF REMOTE SENSING TO SHORELINE-FORM ANALYSIS Quarterly Report, 2 Dec. 1975 - 2 Mar. 1976

Robert Dolan, Principal Investigator, Bruce Hayden, and Jeffrey Heywood 27 Apr. 1976 34 p ref ERTS

(Contract NAS5-20999)

(E76-10326; NASA-CR-147205) Avail: NTIS HC \$4.00 CSCL 08B

The author has identified the following significant results. Orientation of the shoreline segments of Assateague Island (55 km) was measured from LANDSAT 2 imagery enlarged to 1:250,000 and 1:80,000. Long term trends in shoreline dynamics were established by mapping shoreline and storm-surge penetration changes from historical low altitude aerial photography spanning four decades.

N76-23658*# California Univ., Berkeley. Space Sciences Lab.

AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA USING REMOTE SENSING TECHNIQUES Semiannual Progress Report

Robert N. Colwell, Principal Investigator 31 Dec. 1975 361 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP (Grant NGL-05-003-404)

(E76-10332; NASA-CR-147213; SSL-Ser-17-Issue-19) Avail: NTIS HC \$10.50 CSCL 08H

N76-23663*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.

CLASSIFYING AND MONITORING WATER QUALITY BY USE OF SATELLITE IMAGERY

James P. Scherz (Wis. Univ.), Douglas R. Crane (Wis. Univ.),

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

and Robert H. Rogers Sep. 1975 27 p refs Presented at the Intern. Conf. on Environ. Sensing and Assessment, Las Vegas, Nev. 14-19 Sep. 1975
(Contract NAS5-20942)
(NASA-CR-144752; BSR-4197) Avail: NTIS HC \$4.00 CSCL 08H

A technique in which LANDSAT measurements from very clear lakes are subtracted from measurements from other lakes in order to remove atmospheric and surface noise effects to obtain a residual signal dependent only on the material suspended in the water is described. This residual signal is used by the Multispectral Data Analysis System as a basis for producing color categorized imagery showing lakes by type and concentration of suspended material. Several hundred lakes in the Madison and Spooner, Wisconsin area were categorized for tannin or non-tannin waters and for the degree of algae, silt, weeds, and bottom effects. Author

N76-23670# Committee on Science and Technology (U. S. House).

THE ENERGY RELATED APPLICATIONS OF HELIUM

Washington 1975 578 p refs Hearing before Subcomm. on Energy Res., Development and Demonstration of Comm. on Sci. and Technol., 94th Congr., 1st Sess., No. 10, 7 May 1975 (GPO-54-198) Avail: Subcomm. on Energy Res., Development and Demonstration

The limited supplies and conservation of helium are considered in terms of potential energy related uses. Technologies utilizing helium considered include: superconducting power transmission, superconducting magnetic energy storage and fusion reactors. Cumulative helium requirements are estimated through the year 2030 along with the cost of extracting helium from the atmosphere and natural gas. Private storage of excess helium to meet future demands is recommended. J.M.S.

N76-23774# Oak Ridge National Lab., Tenn.

STATISTICAL ANALYSIS OF ENVIRONMENTAL DATA

J. J. Beauchamp, K. O. Bowman, and F. L. Miller, Jr. Oct. 1975 29 p

(Contract W-7405-eng-26)

(UCCND-CSD-INF-64) Avail: NTIS HC \$4.00

The analyses are summarized of data from samples taken around the Browns Ferry Nuclear Plant located in Northern Alabama. The data collection was begun in 1968 and a wide variety of types of samples were gathered on a regular basis. The statistical analysis of environmental data involving very low-levels of radioactivity is discussed. Applications of computer calculations for data processing are described. ERA

N76-23780 Alaska Univ., College.

PROPAGATION AND OBSERVATIONS OF VLF EMISSIONS IN THE AURORAL ZONE Ph.D. Thesis

Rajendra Nath Srivastava 1974 177 p

Avail: Univ. Microfilms Order No. 76-10865

Very low frequency data from the two auroral zone ground stations at College (dp. lat. 64.62 N) and Bar I (dp. lat. 70.20 N) situated on the same geomagnetic meridian were analyzed. The data contained many naturally occurring very low frequency emissions called hiss and chorus in the range of a few hundred Hz to a few kHz which were identified at the ground level both from the chart records and by aural monitoring of the magnetic tape data. Examples of events, indicating relationships of ELF VLF emissions with the manifestations of auroral substorm phenomena, were studied using all-sky camera data, magnetic and 30 MHz riometer records. Dissert. Abstr.

N76-23803# Sandia Labs., Albuquerque, N.Mex.

WIND POWER CLIMATOLOGY OF THE UNITED STATES

J. W. Reed Jan. 1975 163 p Sponsored by ERDA

(SAND-74-0348) Avail: NTIS HC \$7.60

All suitable data in the National Climatic Center archives, for 758 stations, were analyzed for monthly, seasonal, and annual average wind power. Results were assembled in maps with equal power (isodyn) contours to show geographic regions most suitable

for wind power exploitation. An almanac of all these wind speed distributions and power data tabulations, ordered by state and region and suitable for referencing is presented. Wind speed versus height above ground relationships were examined with upper air climatologies at 85 kPa and 70 kPa pressure-altitude levels and certain micrometeorological research towers. An often-used rule-of-thumb appears adequate: that wind speed increases in proportion to the one-seventh power of height above ground. Thus, wind power increases with the three-sevenths power of height, for use in sizing designs for wind turbines and mounts. Author (ERA)

N76-23805# Naval Postgraduate School, Monterey, Calif.

USE OF THE NOAA-2 DIGITIZED SATELLITE DATA FOR DIAGNOSING MARINE FOG IN THE NORTH PACIFIC OCEAN AREA M.S. Thesis

Ronald E. Hale and Robert J. Renard Sep. 1975 92 p refs (AD-A018329; NPS-51HL75091) Avail: NTIS CSCL 04/2

Digital NOAA-2 visual and daytime infrared satellite data and marine surface synoptic reports, North Pacific Ocean, July 1973, are computer processed and diagnosed in an attempt to develop a scheme for identifying fog over open ocean areas as a function of satellite information only. Using approximately 3,250 ship observations as ground-truth data, present and past weather, visibility, and cloud cover and type, were sorted into eleven categories and related to the satellite data observed within two hours of the ship report. Critical visual (brightness) and infrared (temperature) count values, separately and in combination, are specified for the purpose of discriminating fog from no-fog marine areas. Satellite count-value distribution for select categories are illustrated by histograms; the relative accuracies in separating fog from no fog as a function of visual and infrared count values are shown by skill-score analyses. GRA

N76-24658*# Sheffield Univ. (England). Dept. of Geography. A METHODOLOGY FOR SMALL SCALE RURAL LAND USE MAPPING IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY. 1: INTRODUCTION

J. L. VanGanderen, Principal Investigator and B. F. Lock Jan. 1976 7 p refs Sponsored by NASA EREP

(E76-10338; NASA-CR-147221) Avail: NTIS HC \$3.50 CSCL 08B

The author has identified the following significant results. This research program has developed a viable methodology for producing small scale rural land use maps in semi-arid developing countries using imagery obtained from orbital multispectral scanners.

N76-24659*# Sheffield Univ. (England). Dept. of Geography. A METHODOLOGY FOR SMALL SCALE RURAL LAND USE MAPPING IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY. 2: CAPABILITIES OF REMOTE SENSING TECHNIQUES FOR LAND USE SURVEYS

J. L. VanGanderen, Principal Investigator and B. F. Lock Feb. 1976 21 p refs Sponsored by NASA EREP

(E76-10339; NASA-CR-147222) Avail: NTIS HC \$3.50 CSCL 08B

N76-24662*# Ohio Dept. of Economic and Community Development, Columbus.

THE OHIO LAND ALLOCATION MODEL: REPORT ON PHASE 1

Oscar Fisch, Principal Investigator and Steven I. Gordon Jan. 1976 81 p refs ERTS

(Contract NAS5-22399)

(E76-10342; NASA-CR-147234) Avail: NTIS HC \$5.00 CSCL 08B

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N76-24669*# Science Applications, Inc., La Jolla, Calif.
DETERMINATION OF AEROSOL CONTENT IN THE ATMOSPHERE FROM LANDSAT DATA Progress Report, 1 Feb. - 30 Apr. 1976
 M. Griggs, Principal Investigator 1 May 1976 14 p ERTS (Contract NAS5-20899)
 (E76-10349; NASA-CR-147240; SAI-76-595-LJ; PR-5) Avail: NTIS HC \$3.50 CSCL 04A

N76-24671*# Zurich Univ. (Switzerland). Dept. of Geography.
NATURAL RESOURCES INVENTORY AND LAND EVALUATION IN SWITZERLAND Quarterly Report
 Harold Haefner [1975] 5 p refs Sponsored by NASA ERTS (E76-10351; NASA-CR-147243; QR-3) Avail: NTIS HC \$3.50 CSCL 08F

N76-24681*# Old Dominion Univ., Norfolk, Va. Dept. of Physics and Geophysical Sciences.
USE OF LARS SYSTEM FOR THE QUANTITATIVE DETERMINATION OF SMOKE PLUME LATERAL DIFFUSION COEFFICIENTS FROM ERTS IMAGES OF VIRGINIA
 R. N. Blais, G. E. Copeland, and T. H. Lerner [1975] 13 p refs
 (Grant NGL-47-003-067)
 (NASA-CR-148137) Avail: NTIS HC \$3.50 CSCL 13B

A technique for measuring smoke plume of large industrial sources observed by satellite using LARSYS is proposed. A Gaussian plume model is described, integrated in the vertical, and inverted to yield a form for the lateral diffusion coefficient, K_y . Given u , wind speed; y sub 1, the horizontal distance of a line of constant brightness from the plume symmetry axis a distance x sub 1, downstream from reference point at $x = x$ sub 2, $y = 0$, then $K_y = u ((y \text{ sub } 1) \text{ to the 2nd power}) / 2 x \text{ sub } 1 \ln (x \text{ sub } 2 / x \text{ sub } 1)$. The technique is applied to a plume from a power plant at Chester, Virginia, imaged August 31, 1973 by LANDSAT I. The plume bends slightly to the left 4.3 km from the source and estimates yield K_y of 28 sq m/sec near the source, and 19 sq m/sec beyond the bend. Maximum ground concentrations are estimated between 32 and 64 ug/cu m. Existing meteorological data would not explain such concentrations.
 Author

N76-24687# Bristol Univ. (England). Dept. of Electrical Engineering.
SIMULATION OF FLOOD WAVES IN CHANNELS Ph.D. Thesis
 S. Huntington Apr. 1975 234 p refs
 Avail: NTIS HC \$8.00

Problems associated with the effects of modifying flood plains in a channel system which is expected to carry an accentuated hydrograph are dealt with in the context of urbanization of an area susceptible to flooding. Both physical and numerical model studies were carried out in order to study the effectiveness of flood plains in controlling flood levels. Results from the physical model indicate in a qualitative manner the performance of various geometries of flood plain and the effect of downstream controls. On the basis of available data, the numerical model is shown to simulate the physical model results sufficiently well to justify application of the basic techniques to flood wave propagation in real rivers.
 ESA

N76-24751*# Environmental Research Inst. of Michigan, Ann Arbor.
SPECTRAL REFLECTANCE AND RADIANCE CHARACTERISTICS OF WATER POLLUTANTS Final Report, Sep. 1974 - Jun. 1975

C. T. Wezernak, R. E. Turner, and D. R. Lyzenga Washington
 NASA Apr. 1976 230 p refs
 (Contract NAS1-13589)
 (NASA-CR-2665; Rept-112000-9-F) Avail: NTIS HC \$8.00 CSCL 13B

Spectral reflectance characteristics of water pollutants and water bodies were compiled using the existing literature. Radiance calculations were performed at satellite altitude for selected illumination angles and atmospheric conditions. The work described in this report was limited to the reflective portion of the spectrum between 0.40 micrometer to 1.0 micrometer.

Author

N76-24757# Bochum Observatory (West Germany). Inst. fuer Weltraumforschung.
MEASUREMENT OF WATER SURFACE INFRARED RADIATION TEMPERATURE ALONG THE ITALIAN ADRIATIC COAST USING VHRR SATELLITE DATA [MESSUNG DER INFRAROTSTRAHLUNGSTEMPERATUR DER WASSEROBERFLAECHE IM KUESTENVERLAUF DER ITALIENISCHEN ADRIA MITTELS VHRR-SATELLITENDATEN]
 Heinz Kaminski Mar. 1975 16 p refs In GERMAN; ENGLISH summary Presented at the 22nd Rass. Intern. Electronica Nuci. ed Aerospaziale, Rome, Mar. 1975
 Avail: NTIS HC \$3.50

A zone with a distinct temperature gradient in the area of the Italian Adriatic coast was found from the data of the environmental earth research satellites NOAA 2, 3, and 4. This coastal zone obviously depends on the submarine topography, difference in density of the water masses, constant wind streams, influence of the tides, and inflows from the Alps and the Apennines. The zone can be monitored permanently the whole year long and it shows distinct maximum in the winter half-year. Therefore the mixing with the free Adriatic water is obviously very much limited, so that load factors resulting from industrial sites and urbanizations are to be taken into consideration concerning their quantity for this small constant transport zone in the coastal area in immediate front of the Italian Adriatic. The results of environmental earth research satellites make it possible to carry out large area planning and large area supervisions. The present result is part of a voluminous study describing the supervision of the European waters and the atmosphere. The overlapping study is in the hands of the European Council.
 ESA

N76-24759# Bochum Observatory (West Germany). Inst. fuer Weltraumforschung.
STUDY OF A EUROPEAN AIR AND WATER POLLUTION MONITORING SYSTEM USING ENVIRONMENTAL AND GEOPHYSICAL SATELLITES [STUDIE FUER EIN EUROPAEISCHES UEBERWACHUNGSSYSTEM ZUR BESTIMMUNG DER LUFT- UND WASSERVERSCHMUTZUNG MITTELS UMWELTUND ERDFORSCHUNGSSATELLITEN]
 Heinz Kaminski 1974 64 p refs In GERMAN; ENGLISH summary Presented at the Symp. of the Foederation Europaeischer Gewaesserschutz, Strasbourg, 23-25 Oct. 1974
 Avail: NTIS HC \$4.50

A European environmental research program is proposed based on satellites. Using NOAA satellite data, it is shown how environmental research satellites can already contribute to the consideration of supranational planning. Problems concerning waste disposal and storage, and its discharge into the air and water are discussed based on satellite data. A model investigation is proposed covering a region which includes the North of France, South Belgium, and the North Rhine-Westphalia area. This region contains an extreme agglomeration of industry and urban areas.
 ESA

N76-24760# Bochum Observatory (West Germany). Inst. fuer Weltraumforschung.
SATELLITE BASE DATA USED FOR AN ECONOMICAL REMOTE SENSING PROGRAM [SATELLITEN-BASISDATEN (SBD) ALS AUSGANG FUER EIN OEKONOMISCHES ERDERKUNDUNGSPROGRAMM - REMOTE SENSING]
 Heinz Kaminski 1975 41 p refs In GERMAN Presented at

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the DFVLR and DFG Seminary on Remote Sensing, Porz-Wahn, West Germany, 7-11 Apr. 1975
Avail: NTIS HC \$4.00

A number of examples is given to illustrate the application of IR remote sensor data to pollution and regional planning problems in Europe. The data is available from NOAA 2 and NOAA 3 satellites practically without cost, and the processing costs thereof are within realistic limits. ESA

N76-25605*# Earth Satellite Corp., Washington, D.C.
STUDY OF MESOSCALE EXCHANGE PROCESSES UTILIZING LANDSAT AIR MASS CLOUD IMAGERY Interim Report, Mar. - May 1976
Earl S. Merritt and Romeo R. Sabatini, Principal Investigators
May 1976 6 p ERTS
(Contract NAS5-20944)
(E76-10358; NASA-CR-147928) Avail: NTIS HC \$3.50 CSCL 04A

N76-25608*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. INVESTIGATION OF THE ECOLOGICAL ENVIRONMENT INDEX FROM OBSERVATION OF THE REGIONAL VEGETATION COVER AND THEIR GROWING CONDITION Quarterly Report
Takakazu Maruyasu and Iwao Nakajima, Principal Investigators (Ministry of Agriculture and Forestry, Tokyo) 1 May 1976 4 p
Sponsored by NASA ERTS
(E76-10361; NASA-CR-147955) Avail: NTIS HC \$3.50 CSCL 08F

N76-25609*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. LAND USE CLASSIFICATION BY SPECTRAL PATTERN ANALYSIS; PRELIMINARY REPORT Quarterly Report
Takakazu Maruyasu and Shunji Murai, Principal Investigators (Tokyo Univ.) 19 Apr. 1976 4 p Sponsored by NASA ERTS
(E76-10362; NASA-CR-147956) Avail: NTIS HC \$3.50 CSCL 04B

N76-25610*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. INVESTIGATION OF VARIATIONS IN THE PROMINENT OCEANIC CURRENT, KUROSHIO Quarterly Report
Takakazu Maruyasu and Daitaro Shoji, Principal Investigators (Maritime Safety Agency, Tokyo) 1 May 1976 10 p Sponsored by NASA ERTS
(E76-10363; NASA-CR-147957) Avail: NTIS HC \$3.50 CSCL 08C

The author has identified the following significant results. From ocean current analysis, it is concluded that the vortex was formed when the stream axis of the Kuroshio was gradually approaching Shiono Misaki. The sea surface temperatures in the area were found to be nearly homogenous having the values of 27.3 to 27.8C. Transparency of the water was better on the east side of Shiono Misaki than on the west side, the values being 20 to 27 m against 13m. Surface salinity distribution had a considerably high value of 33.7‰ on the east side, decreasing toward the west to become 32‰.

N76-25611*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. CLASSIFICATION OF SHORELINES Quarterly Report
Takakazu Maruyasu and Daitaro Shoji, Principal Investigators (Maritime Safety Agency, Tokyo) 1 May 1976 8 p Sponsored

by NASA. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10364; NASA-CR-147930) Avail: NTIS HC \$3.50 CSCL 04B

N76-25612*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. APPLICATION OF LANDSAT-2 DATA FOR UNDERSTANDING ENVIRONMENTAL CHANGE IN THE COASTAL AND OFFSHORE ZONE Quarterly Progress Report, Jan. - Mar. 1976
Takakazu Maruyasu and Kiyoshi Tsuchiya, Principal Investigators (National Space Development Agency, Tokyo) 30 Apr. 1976 2 p Sponsored by NASA and Science and Technol. Agency, Tokyo ERTS
(E76-10365; NASA-CR-147958) Avail: NTIS HC \$3.50 CSCL 04B

N76-25613*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. A STUDY ON CHANGE OF ENVIRONMENTAL CONDITION OF ISE BAY USING LANDSAT DATA Quarterly Report
Takakazu Maruyasu, Principal Investigator 10 May 1976 13 p
Sponsored by NASA ERTS
(E76-10366; NASA-CR-147931) Avail: NTIS HC \$3.50 CSCL 04B

N76-25620*# Environmental Research and Technology, Inc., Concord, Mass.
THE USE OF LANDSAT DATA TO STUDY MESOSCALE CLOUD FEATURES Quarterly Progress Report, Oct. - Dec. 1975
Pieter Feteris, Principal Investigator, Anthony Lisa, and Mary Grace Fowler Jan. 1976 16 p ERTS
(Contract NAS5-20804)
(E76-10375; NASA-CR-147968; P-619-4) Avail: NTIS HC \$3.50 CSCL 04B

The author has identified the following significant results. Analysis of a complex cloud banding case over the Adirondacks on 20 July 1974 gave evidence that processes other than those recognized by the Rayleigh-Kuettner theory are capable of giving rise to cloud bands. Other situations studied verified that elementary wave theory is useful under proper conditions.

N76-25621*# Federation of Rocky Mountain States, Inc., Denver, Colo.
A REGIONAL LAND USE SURVEY BASED ON REMOTE SENSING AND OTHER DATA Quarterly Report, 10 Oct. 1975 - 10 Jan. 1976
George Nez, Principal Investigator 10 Jan. 1976 35 p ERTS
(Contract NAS5-22338)
(E76-10376; NASA-CR-147969; QR-3) Avail: NTIS HC \$4.00 CSCL 08B

N76-25622*# Nebraska Univ., Lincoln. Conservation and Survey Div.
APPLICATION OF LANDSAT IMAGERY IN LAND USE INVENTORY AND CLASSIFICATION IN NEBRASKA Progress Report, 10 Sep. - 10 Dec. 1975
Marvin P. Carlson, Principal Investigator and Paul M. Seewers 10 Dec. 1975 6 p ERTS
(Contract NAS5-20814)
(E76-10377; NASA-CR-147970; Rept-3) Avail: NTIS HC \$3.50 CSCL 08B

N76-25639* West Florida Univ., Pensacola.
[DETECTION AND/OR PREVENTION OF HUMAN DISEASES THROUGH REMOTE SENSING] Quarterly Report
 Joe A. Edmisten [1976] 43 p refs
 (Contract NAS9-11870)

(NASA-CR-147751; QR-3) Avail: NTIS HC \$4.00 CSCL 06F
 The use of remote sensors for the detection of probable areas of disease infestation, and possibly as a tool in the control of these diseases, is discussed. Particular attention is given to malaria, encephalitis, and Rocky Mountain Spotted Fever. The vector ecology, epidemiology, and pathogenesis of these diseases are examined. The use of remote sensors to detect the presence of Red Tide is also discussed. D.M.L.

N76-25688* California Univ., Berkeley. Lawrence Berkeley Lab.
ENVIRONMENTAL MEASUREMENTS OF AIR AND WATER QUALITY

D. A. Mack May 1975 12 p refs Presented at ISPPA Symp., Stresa, Italy, 20 May 1975 Sponsored in part by NSF (Contract W-7405-eng-48)
 (LBL-3818; Conf-750521-5) Avail: NTIS HC \$4.00

New energy conversion processes may aggravate the problem of maintaining a high quality of our environment. Central to the concept of maintaining high quality is the need to measure those parameters which contribute to environmental degradation. There is thus an obvious requirement for use of accurate and effective instrumentation. The report lists the most prevalent air and water pollutants, note typical levels encountered in background and urban concentrations and examine the methods presently employed in their analysis. Author (ERA)

N76-25697* Calspan Corp., Buffalo, N.Y.
SAMPLING AND IDENTIFICATION OF POLLUTANT OILS IN INDUSTRIAL WATERCOURSES Final Report, Jul. 1968 - Jul. 1971
 Robert E. Baier, Edward A. Gasielki, Richard P. Leonard, and Eugene J. Mack Feb. 1976 256 p refs
 (Grant EPA-WPRD-263-01-68)
 (PB-249362/5; EPA-600/2-76-031) Avail: NTIS HC \$9.00 CSCL 07D

Simple, yet quantitative, methods for retrieval of oil slick specimens are described which are usable on all types of pollutant layers, ranging from near-zero thickness to inches in thickness, irrespective of their degree of weathering: emulsification, or admixture with debris. Techniques which fail in such situations are also described. An analytical scheme for the determination of organic pollutants in industrial waters by chloroform extraction (below pH 8) and carbon tetrachloride extraction (above pH 8) is demonstrated to be superior to more generally used hexane extraction techniques. Numerous examples illustrating the use of gas chromatography and infrared spectroscopy for pollution analysis are presented. Applications of the various analytical methods considered are discussed with specific reference to the correlation of oil slick components with pollutants in industrial outfalls i.e., evaluation of an inverted siphon sewer as an oil trap. GRA

N76-25700* Environmental Measurements, Inc., San Francisco, Calif.
EVALUATION OF THE CORRELATION SPECTROMETER AS AN AREA SO2 MONITOR Final Report
 R. B. Sperling Oct. 1975 115 p refs
 (Contract EPA-68-02-1773)
 (PB-249113/2; EPA-600/2-75-077) Avail: NTIS HC \$5.50 CSCL 14B

A field evaluation was conducted of the Barringer Correlation Spectrometer (COSPEC) at a pulverized coal fired power plant. The Barringer COSPEC II instrument, an SO2 remote sensor, was compared to the manual in-stack SO2 and velocity compliance tests for emission measurements. The correlation for short term (one hour or less) comparison was poor. Higher correlations for

SO2 emission rates on a daily basis were found. In addition to the COSPEC II, a COSPEC III and COSPEC IV were used in the study. Correlations among the three instruments were good (90-95%). Main source of error in the remote measurements was the wind velocity determination. For a short time span of less than an hour, wind velocity may vary 100%, and only averages can be obtained for the measurements. GRA

N76-25706* Lockheed Electronics Co., Houston, Tex.
WATER VAPOR AS AN ATMOSPHERIC ATTENUATOR TO THE SATELLITE-OBSERVED SPECTRAL RADIANCE
 W. V. Abeele Apr. 1976 14 p refs
 (Contract NAS9-12200)
 (NASA-CR-147743; LEC-8478; JSC-11163) Avail: NTIS HC \$3.50 CSCL 04A

The importance of precipitable water as an atmospheric attenuator to the satellite-observed spectral radiance is summarized. Author

N76-25707* Lockheed Electronics Co., Houston, Tex.
ACCURACY OF SATELLITE DERIVED RADIOMETRIC DATA
 W. V. Abeele Apr. 1976 96 p refs
 (Contract NAS9-12200)
 (NASA-CR-147744; LEC-8545; JSC-11177) Avail: NTIS HC \$5.00 CSCL 04A

Plotting of the mean errors of daily mean air temperature estimates suggests that water vapor is a possible factor in the high standard errors of estimate obtained. Author

N76-25753* Hawaii Inst. of Geophysics, Honolulu.
SOURCES AND SEDIMENT YIELD OF HAWAIIAN WATERSHED AND COASTAL SEDIMENTS Completion Report
 Pow-foong Fan 1975 14 p refs
 (Contract DI-14-31-0001-5011)
 (PB-248045/7; W76-02369; HIG-Contrib-707;
 OWRT-A-043-HI(3)) Avail: NTIS HC \$3.50 CSCL 08G

The mineral composition as well as the texture of Hawaiian watershed and coastal sediments is dependent on various parameters. Geology, climatology, vegetation, stream slope and channel morphology, bathymetry, and cultural activities are important. Hawaiian streams enter the ocean basin through one of the following kinds of environment: estuaries, bays, lagoons, or mouths of tidal streams. The coastal environments serve as temporary sinks for the tidal streams. The coastal environments serve as temporary sinks for the sediments. Four representative watershed coastal environments from Oahu were selected for detailed study. They were Kahana, Kaneohe, Hawaii Kai, and Pearl Harbor. GRA

N76-26614* Junta Nacional de Planificacion, Quito (Ecuador).
FORESTRY, GEOLOGY AND HYDROLOGICAL INVESTIGATIONS FROM ERTS-1 IMAGERY IN TWO AREAS OF ECUADOR, SOUTH AMERICA Final Report, Jan. - Nov. 1973
 Nestor Vega Moreno, Principal Investigator Nov. 1973 41 p
 Sponsored by NASA and Natl. Planning Council, Ecuador ERTS
 (E76-10371; NASA-CR-147964) Avail: NTIS HC \$4.00 CSCL 08F

The author has identified the following significant results. In the Oriente area, well-drained forests containing commercially valuable hardwoods can be recognized confidently and delineated quickly on the ERTS imagery. In the tropical rainforest, ERTS can provide an abundance of inferential information about large scale geologic structures. ERTS imagery is better than normal aerial photography for recognizing linears. The imagery is particularly useful for updating maps of the distributary system of the Guagas River Basin and of any other river with a similarly rapid changing channel pattern.

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N76-26644* Georgia Dept. of Natural Resources, Atlanta.
LAND USE/STATE AND LOCAL USERS, SUMMARY
Charles M. Parrish, III /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 129-150 refs
CSCL 08B

Alternative approaches to remote sensing applications in state and local resource management problems are discussed. Examples of application of remotely sensed data are given. User requirements for future applications are emphasized. J.M.S.

N76-26649* Delaware Univ., Newark.
APPLICATIONS OF REMOTE-SENSING TECHNOLOGY TO ENVIRONMENTAL PROBLEMS OF DELAWARE AND DELAWARE BAY
D. Bartlett, V. Klemas, W. Philpot, and R. Rogers (Bendix Aerospace Systems Div.) /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 188-194 refs
CSCL 08C

Digital processing of multispectral LANDSAT data was used to develop a computerized model for predicting oil slick movement within the Delaware Bay. LANDSAT imagery was also used to monitor offshore waste disposal sites for mapping of wetlands, and charting of tidal currents. G.G.

N76-26651* National Aeronautics and Space Administration, Earth Resources Labs., Bay St. Louis, Miss.
SOUTH LOUISIANA REMOTE-SENSING ENVIRONMENTAL INFORMATION SYSTEM
J. Paul Gordon (Corps of Engr., New Orleans), Robert H. Schroeder (Corps of Engr., New Orleans), and Robert H. Cartmill /In its NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 217-223
CSCL 08F

Satellite gathered remote sensor data were used to update a basic environmental atlas of southern Louisiana to reflect recent dynamic geological changes, such as erosion by wave action along the coast and active delta building in the lower part of the Mississippi Basin. Standard pattern recognition programs were utilized to update LANDSAT pictures for three categories (generalized land use, ecological zones and vegetation) to obtain a simulated color photomap for LANDSAT frames for further rectification by a table lookup program. G.G.

N76-26654* Alaska Univ., Fairbanks. Geophysical Inst.
ENVIRONMENTAL ASSESSMENT OF RESOURCE DEVELOPMENT IN THE ALASKA COASTAL ZONE BASED ON LANDSAT IMAGERY
A. E. Belon, J. M. Miller, and W. J. Stringer /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 242-260 refs

(Contracts NAS5-21833; NAS5-20959; Grant NGL-02-001-092)

CSCL 08C

LANDSAT imagery was interpreted to derive color coded maps of the physical parameters of the Alaskan coastal zone. Synoptic overviews depict sea surface circulation, sediment transport, and ice cover dimensions. G.G.

N76-26656* Environmental Protection Agency, Washington, D.C.
OILSPILL SURVEILLANCE, DETECTION, AND EVALUATION BY REMOTE SENSING
Donald R. Jones /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 271-279
CSCL 13B

Aerial and fixed platform oil spill detection systems primarily utilize remote sensors for data acquisition and pollution monitoring purposes. In addition to aerial photography and infrared reflectance

sensors, a laser backscatter sensor and an ultraviolet fluorescence sensor are considered for application in pollution surveillance systems. G.G.

N76-26657* Mississippi State Office of Science and Technology, Jackson.
REMOTE-SENSING APPLICATIONS IN THE STATE OF MISSISSIPPI
P. T. Bankston /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 282-290
CSCL 08B

A computer derived land use classification scheme for infrared LANDSAT imagery was developed and applied to update existing Mississippi coastline data. Inventory classifications were accomplished by photographic enlargement and photointerpretations showing color coded resources on the ground. G.G.

N76-26658* State Planning Office, Madison, Wis.
INFORMATION FLOW OF LAND AND WATER-RELATED DATA IN THE STATE OF WISCONSIN
Allen H. Miller /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 291-296
CSCL 05B

Digital data from the infrared LANDSAT imagery were used to classify eutrophication levels of lakes in an effort to observe the effect of thermal discharges from power stations. LANDSAT data were also applied to identify and monitor wetlands, for soil surveys, sedimentation transport, and in general to assist in land use planning and resources management. G.G.

N76-26660* Arizona Resources Information System, Phoenix.
REMOTE SENSING IN ARIZONA
Carl C. Winikka and Robert E. Adams (Ariz. Dept. of Transportation) /In its NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 300-314

CSCL 05B

Orthophotoquads prepared from high altitude photography and LANDSAT imagery were utilized for land use mapping and urban development planning. LANDSAT imagery of rough terrains were evaluated by photographic projection on a viewer screen for enlargement of details. G.G.

N76-26666* Ohio-Kentucky-Indiana Regional Council of Governments, Cincinnati.
THE USE OF SATELLITE DATA FOR REGIONAL PLANNING
A. H. Hessling and Timothy G. Mara /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 356-358

CSCL 05B

The experience of the Ohio-Kentucky-Indiana Regional Council of Governments in its development of a regional land use inventory from computer processing of LANDSAT 1 digital tapes and the use of those data in the OKI water quality planning program are discussed. A major part of the planning program is the prediction of water quality in rivers and lakes resulting from existing and future land uses. A model has been developed that can predict the flow of sediment, total phosphorus, total nitrogen, and organic wastes into major streams. An essential input to this model is an accurate map of land use derived from LANDSAT 1 digital tapes. Author

N76-26667* Department of City Planning, Los Angeles, Calif.
POLICY IMPLICATIONS IN DEVELOPING A LAND USE MANAGEMENT INFORMATION SYSTEMS
Albert J. Landini /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 359-365
CSCL 05B

The current land use map for the city of Los Angeles was developed by the guesstimation process and provides single stage information for each level in the critical geographical hierarchy for land use planning management. Processing and incorporation of LANDSAT data in the land use information system requires special funding; however, computergraphic maps are able to provide a viable information system for city planning and management. G.G.

N76-26675*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Division.
ATMOSPHERIC MODELING RELATED TO THEMATIC MAPPER SCAN GEOMETRY Final Report, 6 Feb. - 31 Mar. 1976

W. A. Malila, J. M. Gleason, and R. C. Cicone Apr. 1976
132 p refs
(Contract NAS9-14819)
(NASA-CR-147792; ERIM-119300-5-F) Avail: NTIS
HC \$6.00 CSCL 04A

A simulation study was carried out to characterize atmospheric effects in LANDSAT-D Thematic Mapper data. In particular, the objective was to determine if any differences would result from using a linear vs. a conical scanning geometry. Insight also was gained about the overall effect of the atmosphere on Thematic Mapper signals, together with the effects of time of day. An added analysis was made of the geometric potential for direct specular reflections (sun glint). The ERIM multispectral system simulation model was used to compute inband Thematic Mapper radiances, taking into account sensor, atmospheric, and surface characteristics. Separate analyses were carried out for the thermal band and seven bands defined in the reflective spectral region. Reflective-region radiances were computed for 40 deg N, 0 deg, and 40 deg S latitudes; June, Mar., and Dec. days; and 9:30 and 11:00 AM solar times for both linear and conical scan modes. Also, accurate simulations of solar and viewing geometries throughout Thematic Mapper orbits were made. It is shown that the atmosphere plays an important role in determining Thematic Mapper radiances, with atmospheric path radiance being the major component of total radiances for short wavelengths and decreasing in importance as wavelength increases. Path radiance is shown to depend heavily on the direct radiation scattering angle and on haze content. Scan-angle-dependent variations were shown to be substantial, especially for the short-wavelength bands. Author

N76-26718*# Kanner (Leo) Associates, Redwood City, Calif.
THE THERMAL RADIO EMISSION OF A CONTAMINATED SEA SURFACE

V. Yu. Rayzer, Ye. A. Sharkov, and V. S. Etkin Washington
NASA May 1976 32 p refs Transl. into ENGLISH from the Russian Report Pr-237
(Contract NASw-2790)
(NASA-TT-F-17033; PR-237) Avail: NTIS HC \$4.00 CSCL 13B

Calculations are made of the radiative characteristics of water-film structures based on the thickness of the contaminating film and its temperature for various dielectric parameters of the contaminants, with allowance made for the formation of water-oil emulsions. Questions on the effective estimation of the thickness and dielectric parameters of films with the aid of remote UHF passive measurements of contaminated sea-surface areas are discussed. Calculations are compared with data from model experiments. Author

N76-26718*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

A FOUR-CHANNEL PORTABLE SOLAR RADIOMETER FOR MEASURING PARTICULATE AND/OR AEROSOL OPACITY AND CONCENTRATION OF NO2 AND SO2 IN STACK PLUMES

Reginald J. Exton and Ray W. Gregory Washington Jun. 1976
17 p refs
(NASA-TN-D-8182; L-10608) Avail: NTIS HC \$3.50 CSCL 13B

Solar absorption radiometry has been investigated as a method of measuring stackplume effluents. A simple and inexpensive instrument was constructed for observing the sun at four wavelengths: 800, 600, 400, and 310 nm. Higher wavelength channels measured the effect of the particulates and NO2, and an ultraviolet channel measured the contribution of SO2 to the attenuation. Stack-plume measurements of opacity and concentration of NO2 and SO2 were in basic agreement with in-stack measurements. The major limitation on the use of the radiometer is the requirement for an accessible viewing position which allows the sun-plume-observer relationship to be attained. It was concluded that the solar radiometer offers an inexpensive method for monitoring plume effluents when the viewing position is not restricted. Author

N76-26757# R and D Associates, Marina Del Rey, Calif.
REMOTE ASSESSMENT OF GASES Final Technical Report
Leona Marshall Libby Sep. 1975 197 p refs
(Contract MDA903-74-C-0090; ARPA Order 2558)
(AD-A019240; RDA-TR-4302-001) Avail: NTIS CSCL 04/1

Remote assessment of gases by spectroscopic means is presented. The 'windows' of the atmosphere are described. Electromagnetic signatures of gaseous molecules from 1 Mc to 4000 A are computed and the methods to compute are explained. Passive and active methods which have been successful are described. Lasers and solid state detectors which might be useful are surveyed. GRA

N76-26771# National Academy of Sciences - National Research Council, Washington, D.C.

BOMEX BULLETIN NO. 12. FINAL REPORT OF THE BOMAP ADVISORY PANEL. US COMMITTEE FOR THE GLOBAL ATMOSPHERIC RESEARCH PROGRAM

Nov. 1975 91 p refs Sponsored in part by NSF
(PB-249749/3; NOAA-76011304) Avail: NTIS HC \$5.00 CSCL 04B

This is the last issue in the Barbados Oceanographic and Meteorological Experiment (BOMEX) Series. It contains the final report of the Barbados Oceanographic and Meteorological Analysis Project (BOMAP), and includes the Report of the BOMAP Panel and the Report of the Director, BOMAP. The Panel report gives a brief synopsis on the status of BOMAP, and the achievements already reached, and then continues on to identify the critical issues remaining in the program. The report outlines, and then summarizes recommendations. The Director's report is a comprehensive overview of the entire project. Also included are three appendices that list BOMAP Publications, BOMEX Archive Products, and Status of BOMAP Data Sets. A report is included at the end which is entitled: Wind stress and turbulent energy budget measurements in the undisturbed surface boundary layer over the sea; the tern buoy experiment. GRA

N76-27449*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
MICROWAVE REMOTE ENVIRONMENT SOUNDING

K. Ya. Kondratyev, Yu. I. Rabinovich, Yu. M. Timofeyev, and Ye. M. Shulgina Jul. 1976 126 p refs Transl. into ENGLISH of the book "Mikrovolnovoye distantsionnoye zondirovaniye okruzhayushey sredy" Obninsk, Informational Center, 1975 p 1-111

(Contract NASw-2789)
(NASA-TT-F-16930) Avail: NTIS HC \$6.00 CSCL 20N

Microwave remote sounding has two principally important advantages: (1) a multipurpose nature in the sense that the measurement data of outgoing microwave radiation can be used for remote indication of the parameters of the atmosphere, the underlying surface, and the upper soil layer, and (2) all-weather applications which make it possible, for example, to perform thermal sounding in the atmosphere, regardless of cloud conditions. Specific capabilities of microwave remote sounding are considered, beginning with an examination of the physical basis of the method. Author

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

N76-27618# California Univ., Livermore. Lawrence Livermore Lab.

PROGRAM REPORT: FY 1975, ATMOSPHERIC AND GEOPHYSICAL SCIENCES DIVISION, PHYSICS DEPARTMENT

J. B. Knox, ed. and R. C. Orphan, ed. 8 Oct. 1975 34 p refs

(Contract W-7405-eng-48)

(UCRL-51444-75) Avail: NTIS HC \$5.00

The FY 1975 research program conducted by the Atmospheric and Geophysical Sciences Division and supporting segments at Lawrence Livermore Laboratory is reviewed briefly. Specific projects are described, and significant findings of the work are indicated. Unique numerical modeling capabilities in use and under development are described. Applications in regional atmospheric modeling, the San Francisco Bay area air pollution model, studies on the climatic effects of nuclear explosions, research on precipitation scavenging, and studies of the interaction of wind and surface dust are discussed. NSA

N76-27623*# Department of Industry, London (England).

COMPARISONS OF CLOUD COVER EVALUATED FROM LANDSAT IMAGERY AND METEOROLOGICAL STATIONS ACROSS THE BRITISH ISLES Quarterly Report

Eric C. Barrett, Principal Investigator and Colin K. Grant Jun. 1976 47 p refs Sponsored by NASA and Dept. of Industry, London Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10403; NASA-CR-148216; QR-3) Avail: NTIS HC \$4.00 CSCL 04B

The author has identified the following significant results. This stage of the study has confirmed the initial supposition that LANDSAT data could be analyzed to provide useful data on cloud amount, and that useful light would be thrown thereby on the performance of the ground observer of this aspect of the state of the sky. This study, in comparison with previous studies of a similar nature using data from meteorological satellites, has benefited greatly from the much higher resolution data provided by LANDSAT. This has permitted consideration of not only the overall performance of the surface observer in estimating total cloud cover, but also his performance under different sky conditions.

N76-27627*# California State Dept. of Water Resources, Sacramento.

[WATER QUALITY CONDITIONS IN SAN FRANCISCO BAY DELTA] Progress Report

Randall L. Brown, Principal Investigator 9 Jun. 1976 1 p ERTS

(Contract NAS5-20945)

(E76-10408; NASA-CR-148215; PR-4) Avail: NTIS HC \$3.50 CSCL 14E

There are no author-identified significant results in this report.

N76-27628*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

INVESTIGATION OF EARTH'S ALBEDO USING SKYLAB DATA Final Report

Robert E. Turner, Principal Investigator Jan. 1976 82 p refs EREP

(Contract NAS9-13279)

(E76-10409; NASA-CR-147445; ERIM-102200-20-F) Avail: NTIS HC \$5.00 CSCL 04A

The author has identified the following significant results. Specific test sites in the White Sands, New Mexico and Lake Michigan areas were chosen because of their stability and known reflectances. Skylab S192 multispectral data and ERIM aircraft multispectral data were collected for these sites and were compared with results of atmospheric radiative transfer calculations in order to determine the aerosol content of the atmosphere. The spectral shape of the Skylab data compared quite favorably with the nearly simultaneous spectral character of the aircraft data. Although there were difficulties in the calibration of the

S192 instrument which remain unresolved, interesting mathematical and physical relationships were discovered.

N76-27629*# Kansas Univ., Lawrence. Remote Sensing Lab.

METHODS FOR CORRECTING MICROWAVE SCATTERING AND EMISSION MEASUREMENTS FOR ATMOSPHERIC EFFECTS

Mark Komen, Principal Investigator Aug. 1975 32 p refs EREP

(Contract NAS9-13642)

(E76-10412; NASA-CR-147781; CRES-254-6) Avail: NTIS HC \$4.00 CSCL 20N

The author has identified the following significant results. Algorithms were developed to permit correction of scattering coefficient and brightness temperature for the Skylab S193 Radsat for the effects of cloud attenuation. These algorithms depend upon a measurement of the vertically polarized excess brightness temperature at 50 deg incidence angle. This excess temperature is converted to an equivalent 50 deg attenuation, which may then be used to estimate the horizontally polarized excess brightness temperature and reduced scattering coefficient at 50 deg. For angles other than 50 deg, the correction also requires use of the variation of emissivity with salinity and water temperature.

N76-27640*# Kansas Univ. Center for Research, Inc., Lawrence.

THE APPLICATION OF REMOTE SENSING TO RESOURCE MANAGEMENT AND ENVIRONMENTAL QUALITY PROGRAMS IN KANSAS Annual Report, 1 Apr. 1975 - 31 Mar. 1976

B. G. Barr and E. A. Martinko Jul. 1976 65 p

(Grant NGL-17-004-024)

(NASA-CR-148325) Avail: NTIS HC \$4.50 CSCL 05A

Activities of the Kansas Applied Remote Sensing Program (KARS) designed to establish interactions on cooperative projects with decision makers in Kansas agencies in the development and application of remote sensing procedures are reported. Cooperative demonstration projects undertaken with several different agencies involved three principal areas of effort: Wildlife Habitat and Environmental Analysis; Urban and Regional Analysis; Agricultural and Rural Analysis. These projects were designed to concentrate remote sensing concepts and methodologies on existing agency problems to insure the continued relevancy of the program and maximize the possibility for immediate operational use. Completed projects are briefly discussed. Author

N76-27641*# Maryland Univ., Frostburg. Appalachian Environmental Lab.

AN EVALUATION OF THE UTILIZATION OF REMOTE SENSING IN RESOURCE AND ENVIRONMENTAL MANAGEMENT OF THE CHESAPEAKE BAY REGION Final Report, Dec. 1974 - Sep. 1975

Dale B. Fuller, Dan M. Harmon, and Kent B. Fuller Jun. 1976 266 p refs Original contains color illustrations

(Grant NSG-6001)

(NASA-CR-141405) Avail: NTIS HC \$9.00 CSCL 05B

A nine-month study was conducted to assess the effectiveness of the NASA Wallops Chesapeake Bay Ecological Program in remote sensing. The study consisted of a follow-up investigation and information analysis of actual cases in which remote sensing was utilized by management and research personnel in the Chesapeake Bay region. The study concludes that the NASA Wallops Chesapeake Bay Ecological Program is effective, both in terms of costs and performance. Author

N76-27648*# Joint Publications Research Service, Arlington, Va.

SPACECRAFT INVESTIGATE NATURAL RESOURCES

V. S. Agalakov and A. Sh. Sire Washington NASA Jul. 1976 56 p refs Transl. into ENGLISH of the mono. "Novoye v Zhizni, Nauka, Tekhnika, Seriya Nauka o Zemle, No. 4: Kosmicheskiye Apparaty Issleduyut Prirodnyye Resursy" Moscow, Znaniye Press, 1976 p 1-48

(NASA Order W-13183)

(NASA-TT-F-17077) Avail: NTIS HC \$4.50 CSCL 08F

The principles, equipment, and problems of using satellites to study the environment and the earth's natural resources are discussed. Various examples of using satellite data to study natural resources are given. Author

N76-27718* Old Dominion Univ. Research Foundation, Norfolk, Va.

AEROSOL STUDIES. Final Report, 1 Nov. 1972 - 30 Oct. 1975

Franklin S. Harris, Jr. Jun. 1976 7 p

(Grant NGR-47-003-068)

(NASA-CR-148294; PGS-TR-AP-76-37) Avail: NTIS HC \$3.50 CSCL 13B

Various methods of measuring aerosols were studied in terms of the best methods to use, the instruments or techniques actually employed, and those techniques applied in field measurements on air quality as influenced by rocket launch effluents, and in an urban environment. Further studies were initiated on the remote sensing of aerosols by satellites and the influence of aerosols on visibility. The characterization of aerosols by measurement of scattered light was studied on Mie theory calculations. Author

N76-27726* Puerto Rico Nuclear Center, Mayaguez.

ENVIRONMENTAL MONITORING OF Ar-41

D. S. Sasscer and C. Andreu 1975 2 p Presented at the 9th Topical Symp. on Operational Health Phys., Denver

(CONF-760202-14) Avail: NTIS HC \$4.50

The objective of this investigation was to develop a simple and accurate procedure for measuring argon-41 in unrestricted areas when this radioactive noble gas exists in concentrations significantly below the new recommended allowable concentration. These measurements were made in order to provide an accurate and simple verification of the results obtained when using prediction models for the spatial variation of the concentration of gases released from a source. The highly sensitive system which was developed to measure argon-41 at a concentration which is less than 2 percent of the previously allowable value consisted of: connecting a four inch by four inch and a three inch by a three inch sodium iodide detector in parallel; measuring concentrated samples of air in scuba tank filled to 2,200 psi by means of a high pressure pump; and obtaining low radioactive background by locating the detectors and scuba air samples tank in a lead cave with six inch thick walls. Author (NSA)

N76-27727* AEG-Telefunken, Frankfurt am Main (West Germany).

LASER SOURCES FOR GAS ANALYSIS EQUIPMENT IN 2 - 20 MICRON RANGE. PART 2: PARAMETRIC OSCILLATOR FOR 2 - 10 MICRON Final Report [LASERSTR-AHLUNGSQUELLEN FUER GASANALYSEGERAETE IM SPEKTRALBEREICH VON 2 - 20 MICROMETER. TEIL 2: PARAMETRISCHER OSCILLATOR FUER 2 - 10 MICROMETER]

Harald Matthes, N. Marschall, and P. Korczak Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 77 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.

(BMFT-FB-T-75-47) Avail: NTIS HC \$5.00; ZLDI, Munich DM 16.20

A tunable solid state laser in the form of a parametric oscillator can be used for the detection of air pollution gases. The ternary sulfide AgGaS₂ is of special interest for the use as nonlinear-optical material. However, this material was not available in single crystalline form of the required quality. Therefore the growth process was investigated to obtain such high quality crystals. Sufficiently large (5 x 5 x 5 cu mm), crackfree and twinfree crystals could be obtained by the Bridgman method after optimizing the composition of the melt and the geometry of the quartz ampoules. A decisive improvement of the transmission properties could be obtained by a subsequent annealing process. Author (ESA)

N76-27775* Aerospace Corp., El Segundo, Calif. Space Physics Lab.

GLOBAL DISTRIBUTION OF HIGH-ALTITUDE OZONE

FROM A UV SPECTROMETER Interim Report

Lawrence R. Sharp and Hugo R. Rugge 14 Jul. 1975 39 p refs

(Contract F04701-75-C-0076)

(AD-A013694; SAMSO-TR-75-177; TR-0076(6960-04)) Avail: NTIS CSCL 04/1

A satellite-based UV spectrometer that obtained daytime earth radiance measurements in the 1700- to 3100-A region is described. Radiance and earth albedo data are displayed, and a list of available data is provided. A parameter related to the relative high-altitude ($h =$ or > 35 km) ozone concentration is correlated with solar zenith angle, time, and geographic position. GRA

N76-27776* Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

HIGH ALTITUDE EFFECTS SIMULATION (HAES) PROGRAM. REPORT NO. 23: INSTRUMENTATION ANALYSIS AND DATA PROCESSING FOR ROCKETBORNE LWIR SPECTROMETERS WITH APPLICATION TO ROCKET A18.006-2 OF 22 MARCH 1973 Environmental Research Papers

James W. Rogers 8 Oct. 1975 46 p refs

(DNA Proj. NWET-K11BAXHX534)

(AD-A020810; AFCRL-TR-75-0535; AFCRL-ERP-539) Avail: NTIS CSCL 04/1

A liquid-helium-cooled long-wavelength infrared spectrometer was successfully launched on 22 March 1973 from the Poker Flats Research Facility, Alaska. This spectrometer, which employed a circular variable filter (CVF), was developed over a period of five years and provided the first measurements of the infrared spectrum of the upper atmospheric emissions between 7 and 24 micrometers. The data processing proceeded in a step-by-step manner to provide accurate final data with error limits and an understanding of the spectrometer performance. Each step of the data processing is presented in this report which will provide engineers with information on the spectrometer performance and data analysts with the basis for the final assignment of error limits. Similar procedures can also be used for the data reduction of other CVF flights. GRA

N76-27784* Wyoming Univ., Laramie. Dept. of Physics and Astronomy.

WYOMING PAM PROJECT (PRELIMINARY AEROSOL MEASUREMENTS) Final Report

Theodore J. Pepin Sep. 1975 7 p Sponsored in part by DOT (Contract N00014-70-A-0266-0008)

(AD-A020803; App-1) Avail: NTIS CSCL 04/1

In 1971 the University of Wyoming undertook the Wyoming PAM Project, a project designed to build a radiometric instrument to be placed on an Air Force satellite. The purpose of the PAM experiment was to provide first-look type of information from space on the concentration and vertical profile of aerosol particles in the stratosphere. During the project, the University of Wyoming constructed and built two models of the preliminary aerosol measurement package. These particular models were tested, and one of the models was designated as a flight model. GRA

N76-27806* SACLANT ASW Research Center, La Spezia (Italy). **THE SACLANTCEN SHIPBORNE COMPUTER ENVIRONMENTAL DATA ACQUISITION SYSTEM. VOLUME 3: THE METEOROLOGICAL DATA SUBSYSTEM**

Francesco Spina, Claude Gehin, and Mario Menelli 15 Jan. 1976 51 p

(AD-A020849; SACLANTCEN-SM-78-Vol-3) Avail: NTIS CSCL 04/2

An automatic environmental data-logging and computing system installed on board SACLANTCEN's research vessel is described in a series of memoranda. This memorandum describes how measurements of wet and dry air temperature, sea-surface temperature, solar radiation and relative wind speed and direction are obtained and applied to the system. The output comprises magnetic tape records of raw data; paper tape records of converted (humidity and absolute wind speed and direction) and averaged data, and plots of averaged data. Author (GRA)

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GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A76-31698 # Investigation of a new method for calculating the density of the earth's core (Issledovanie novogo metoda vychisleniia plotnosti zemnykh nedr). G. A. Meshcheriakov (L'vovskii Politekhicheskii Institut, Lvov, Ukrainian SSR) and A. V. Golikova (L'vovskii Torgovo-Ekonomicheskii Institut, Lvov, Ukrainian SSR). *Geodeziia, Kartografiia i Aerofotos'emka*, no. 22, 1975, p. 42-53, 11 refs. In Russian.

An analytical method proposed by Meshcheriakov (1973) for determining the density of the lunar core by approximating the density through a certain polynomial is extended to the case of the earth's core. The method is analyzed in detail, and its potential is demonstrated. New models of the earth are obtained and discussed. V.P.

A76-32289 * A very-long-baseline interferometer system for geodetic applications. A. R. Whitney, A. E. E. Rogers, H. F. Hinteregger, C. A. Knight, J. I. Levine, S. Lippincott (Haystack Observatory, Westford, Mass.), T. A. Clark (NASA, Goddard Space Flight Center, Greenbelt, Md.), I. I. Shapiro, and D. S. Robertson (MIT, Cambridge, Mass.). *Radio Science*, vol. 11, May 1976, p. 421-432, 14 refs. NSF Grants No. MPS-71-02109A07; No. DES-74-22712; Contract No. F23601-71-C-0092.

A very-long-baseline interferometer system was designed and built for geodetic applications. Each interferometer terminal records a 360-kHz spectral band of noise from a compact extragalactic radio source. The center frequency of the spectral band can be selected to sample sequentially bands covering a much wider frequency range to obtain subnanosecond accuracy in group-delay measurements. A tunnel-diode pulse generator is used to calibrate the delays in the receiver. The necessary sets of algorithms and computer programs have been developed to analyze the data and have allowed the system to be employed to make accurate determinations of vector baselines, radio-source positions, polar motion, and universal time. (Author)

A76-33191 # The significance of topographic relief in air photo analysis of landscape pattern. P. Gimbarzevsky (Canadian Forestry Service, Forest Management Institute, Ottawa, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 165-176, 9 refs.

A review of the significance of topographic relief in air photo analysis of landscape patterns demonstrates that topographic relief is probably the most common indicator of ground conditions in the conventional analysis of aerial photographs. In practical application of photo interpretation procedures where the work starts with analysis of general image pattern and proceeds toward recognition of specific components of this pattern, a stratification of the land surface based on the relief features is compatible with the hierarchical structure of multilevel biophysical surveys. A general relief pattern describes major physiographic features at a broad regional level, while components of this pattern provide reliable indicators for the recognition of specific details. Diagnostic values of surface configuration components are discussed. Standardization of geomorphic terms in the classification of landforms is highly desirable. S.D.

A76-33215 # Some questions of exploring natural resources with the help of cosmic stations. E. P. Arzhanov (Glavnoe Upravlenie

Geodezii i Kartografii, Moscow, USSR) and Iu. P. Kienko. In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 527-533.

Salyut space station experience in surveying the earth surface in the framework of topographic, geological and geodetic investigation is reviewed. Specifications of Salyut-based photography of the earth surface are discussed, emphasizing calibration needs, the use of star cameras for earth survey purposes and atmospheric-optical effects. The topographic survey cameras of Salyut were applied to the fields of cartography, particularly the mapping of remote areas, the detection of local physico-geographical conditions (e.g., Caspian sea coastline changes), fossil-fuel prospecting, agriculture and soil mapping. B.J.

A76-34719 # General and specialized mapmaking from photographic material from the Salyut-4 orbiting station (O kompleksnom i otraslevom kartografirovani po materialam s'emki s orbital'noi stantsii 'Saliut-4'). L. I. Zlobin, Iu. G. Kel'ner, and V. V. Kozlov. *Geodeziia i Kartografiia*, Apr. 1976, p. 29-35. In Russian.

Imagery from the Salyut-4 orbiting station will be used to construct maps of the USSR for general use and for specialized purposes such as inventory of land use and natural resources. Results of an analysis of the geological structure of the Kazakhstan region are presented. Structural features, in particular lineaments, are readily identifiable from the imagery and have revealed sites of potential mineralization. C.K.D.

A76-34725 # A study of the accuracy of a geodetic net constructed by the geometric satellite method (Issledovanie tochnosti postroeniia geodezicheskikh setei geometricheskimi sputnikovym metodom). N. L. Makarenko and V. I. Zubinskii. *Geodeziia i Kartografiia*, Apr. 1976, p. 61-66. In Russian.

A modeling method is used to obtain an a priori assessment of the accuracy of coordinates of points placed in a geodetic reference net using the geometric satellite method. Eleven variant methods using combinations of ground-based, radiointerferometric, laser, and satellite photographic measurements, are used to determine the direction or direction and length of selected chords in a triangular net including 14 points distributed evenly over the territory of the USSR. Results of the analysis show that the precision of the net decreases insignificantly when the error of measurement of the zenith distance of a chord attains 70%. The precision of the net essentially depends on the distribution of space baselines. The accuracy of the net can be increased by 20% if the length of all of the chords is determined by laser measurements of the distance to the satellite over that obtained when only four baselines are measured. C.K.D.

A76-34813. The shape of the earth. D. King-Hele (Royal Aircraft Establishment, Space Dept., Farnborough, Hants., England). *Science*, vol. 192, June 25, 1976, p. 1293-1300, 20 refs.

An historical overview of the evolution of geodesy is presented, and the contributions of satellite geodesy are considered in detail. The development of satellite tracing techniques, from visual observation and observations from kinetheodolites to photographic, Doppler, and laser tracking techniques, is reviewed. Different methods of using observed perturbations in satellite orbits in calculating the geoid are described and compared. Special attention is given to the analysis of resonant orbits. Measurement techniques in the first stages of implementation, including satellite-to-satellite tracking, use of radio altimeters to measure a satellite's height over the ocean, and use of satellite-borne gravity gradiometers to provide accurate measurements of gravity gradients, are outlined. Possible applications of geodesy in such fields as seismology and meteorology are considered. C.K.D.

A76-35057 # Thematic mapping of coral reefs using Landsat data. V. E. Smith (Cranbrook Institute of Science, Bloomfield Hills, Mich.), R. H. Rogers, and L. E. Reed (Bendix Corp., Aerospace Systems Div., Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 585-594.

Recent progress is reported in a continuing study of coral reef monitoring by satellite. Physiographic zones of the Australian Great Barrier Reef (Cape Melville area) were categorized and mapped by automated processing of Landsat (ERTS) tapes. Data products included color-coded, geometrically-correct images (1:250,000 scale) and quantitative inventories of zonal area on selected reefs. Categorized images were evaluated with reference to aerial photography. These results further demonstrate the potential of Landsat data for use in coral reef surveillance, mapping and inventories. (Author)

A76-35097 # Study of land formation in Bangladesh with Landsat-1 imageries. A. Hossain and M. U. Chaudhury. In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1023-1027.

A76-38134 # Interpretation of flooding damage to vegetation in the Smallwood reservoir, Churchill Falls, Labrador. D. Bajzak (Newfoundland, Memorial University, St. John's, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 405-412. 6 refs. Research supported by the Churchill Falls (Labrador) Corp., Canada Center for Remote Sensing, and Maritime Air Command.

Side-looking radar mapping and color IR photography (1:110,000 scale) were used to support in situ limnological studies and bioassays of a large reservoir formed in the Churchill River and Churchill Falls region, where a lake roughly one-third the size of Lake Ontario has been formed. Fish distribution and habitat studies and effects of flooding on submerged vegetation are studied. Side-looking radar imagery accurately reflects the flooding situation, while color IR aerial photography is useful in ascertaining forest fire damage (to spruce and fir stands) and changes in the drainage system. Three zones of vegetation are delineated: completely submerged zone, occasionally submerged zone, shoreline banks. Four major reservoirs have been formed in the area in preparation for hydroelectric power developments. R.D.V.

N76-22825# Southwest Research Inst., San Antonio, Tex. **EVALUATION OF HIGH-RESOLUTION EARTH RESISTIVITY MEASUREMENT TECHNIQUES FOR DETECTING SUBSURFACE CAVITIES IN A GRANITE ENVIRONMENT** Final Report, 12 May - 15 Dec. 1975. Lewis S. Fountain. 15 Dec. 1975. 78 p. refs. (Contract DAAG53-75-C-0213; ARPA Order 3028; SwRI Proj. 14-4250) (AD-A018281) Avail: NTIS CSCL 08/7

The purpose of this work was to experimentally explore the use of earth resistivity measurements using a pole-dipole electrode array in the detection of deep tunnels in a granite environment. Measurements both on the ground surface and in drilled holes

were evaluated. Tests were conducted at two sites existing mine adits or tunnels, one at the Colorado School of Mines Experimental Mine site and one at a Gold Hill, Colorado, site. The mine adits with an approximate 10 x 10-foot (3 x 3-m) cross section were successfully detected from the surface at both locations through overburden thicknesses ranging from 30 to 81 feet (9.1 to 24.7 m). Other geological features of the terrain were also identified by the measurements. Successful detection was also made from a dry borehole that was 16 feet (4.9 m) horizontally displaced from the adit at the adit level. Although near surface geological features produce strong resistivity anomalies, they can be identified. GRA

N76-23665*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.

GEOS-3 PHASE B GROUND TRUTH SUMMARY

C. L. Parsons and L. R. Goodman (NOAA, Rockville, Md.) Nov. 1975. 262 p. refs.

(NASA-TM-X-69360) Avail: NTIS HC \$9.00 CSCL 05B

Ground truth data collected during the experiment systems calibration and evaluation phase of the Geodynamics experimental Ocean Satellite (GEOS-3) experiment are summarized. Both National Weather Service analyses and aircraft sensor data are included. The data are structured to facilitate the use of the various data products in calibrating the GEOS-3 radar altimeter and in assessing the altimeter's sensitivity to geophysical phenomena. Brief statements are made concerning the quality and completeness of the included data. Author

N76-24660*# Milan Univ. (Italy).

GEOMORPHIC AND LANDFORM SURVEY OF NORTHERN APPENNINI Quarterly Report

Carlo M. Marino, Principal Investigator 19 Feb. 1976. 8 p. Sponsored by NASA ERTS

(E76-10340; NASA-CR-147223; QR-2) Avail: NTIS HC \$3.50 CSCL 08B

N76-24668*# Geological Survey, Reston, Va.

OVERALL EVALUATION OF LANDSAT (ERTS) FOLLOW-ON IMAGERY FOR CARTOGRAPHIC APPLICATION Progress Report, 20 May 1975 - 1 Apr. 1976

Alden P. Colvocoresses, Principal Investigator 1 Apr. 1976. 11 p. refs. ERTS

(NASA Order S-543-748)

(E76-10348; NASA-CR-147239) Avail: NTIS HC \$3.50 CSCL 08B

The author has identified the following significant results. The NASA/Cousteau experiment showed that under suitable conditions and with calibration data, the bottom of clear tropical seas can be mapped with LANDSAT to a depth of 22 meters with a root-mean-square error of about 10 percent. This application required the high gain setting of band 4 of the MSS. The experiment also confirmed that a somewhat lower waveband than band 4 would increase the water penetration capability of future LANDSATs. Other experiments illustrated by the reprinting of upper Chesapeake Bay indicate that the original LANDSAT signals must be modulated and optimized for the photographic and lithographic processes. Work by the Canadian mapping agency indicates significant improvements in the control identification and geometric accuracy of LANDSAT cartographic applications.

N76-24679*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.

ON SIMILARITY TRANSFORMATION AND GEODETIC NETWORK DISTORTIONS BASED ON DOPPLER SATELLITE OBSERVATIONS

Alfred Leick and Boudewijn H. W. VanGelder Dec. 1975. 151 p. refs.

(Grant NGR-36-008-204; OSURF Proj. 3820-A1)

(NASA-CR-147152; Rept-235) Avail: NTIS HC \$6.75 CSCL 08B

Models used in geodesy to transform two sets of coordinates are studied and distortions in geodetic networks are investigated. Commonly used transformation models are first reviewed and most of them are interpreted. Differences between various models are discussed. Pitfalls in partial solutions are then considered. It is shown that only as many chords and/or directional elements can be used in the computation as are needed to completely determine the size or shape of the polyhedron implied in the set of Cartesian coordinates. Each additional element causes the normal matrix to be singular provided that all correlations between the chords are used. A number of tables and maps indicating distortions in the NAD 27, Precise Traverse M-R '72, AUS, and SAD 69 geodetic datums are also included. The residuals of the coordinates are scanned for systematic patterns after transforming each geodetic system to the NWL9D Doppler system. Also, an attempt is made to show scale distortions in the NAD 27.

Author

N76-24693# Naval Surface Weapons Center, Dahlgren, Va.
LONG TERM CONSISTENCY IN POSITION OF SITES DETERMINED FROM DOPPLER SATELLITE OBSERVATIONS Final Report

R. J. Anderle Nov. 1975 59 p refs
 (AD-A019522; NSWC/DL-TR-3433) Avail: NTIS CSCL 08/5

Doppler observations of artificial satellites made by mobile receivers have been used to determine the positions of navigation beacons and other isolated sites since 1963. Over this period, improvements in the accuracy of the satellite net of 15 to 20 base stations have yielded an improvement in the computed positions of the isolated sites from 100m to an estimated 1m. This report compares positions of the base stations computed from observations made over the past twelve years using recent geodetic parameters and methods to determine if systematic variations exist in computed positions.

GRA

N76-26616*# Geological Survey, Reston, Va.
PHOTOMAPPING OF THE UNITED STATES

Joseph T. Pilonero, Principal Investigator May 1976 14 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP (E76-10385; NASA-CR-148165) Avail: NTIS HC \$3.50 CSCL 08B

N76-26625*# Milan Univ. (Italy).

GEOMORPHIC AND LANDFORM SURVEY OF NORTHERN APPENNINI Quarterly Report

Carlo M. Marino, Principal Investigator 3 Jun. 1976 4 p Sponsored by NASA ERTS (E76-10397; NASA-CR-148184; QR-3) Avail: NTIS HC \$3.50 CSCL 08B

N76-26775# National Ocean Survey, Las Vegas, Nev.
USE OF CLIMATOLOGICAL AND METEOROLOGICAL DATA IN THE PLANNING AND EXECUTION OF NATIONAL GEODETIC SURVEY FIELD OPERATIONS

Robert J. Leffler Dec. 1975 36 p refs
 (PB-249677/6; NOAA-TM-NOS-NGS-1; NOAA-75121801) Avail: NTIS HC \$4.00 CSCL 04B

The report describes a study that was initiated because of increased interest in the possible applications of available climatological and meteorological data to National Geodetic Survey field operations. The availability, pertinence, uses, and procedures for use of these data are described. Both climatic records and weather forecasts are considered.

GRA

N76-27617*# Ohio State Univ. Research Foundation, Columbus, Dept. of Geodetic Science.

BASIC RESEARCH AND DATA ANALYSIS FOR THE EARTH AND OCEAN PHYSICS APPLICATIONS PROGRAM AND FOR THE NATIONAL GEODETIC SATELLITE PROGRAM Semiannual Status Report, Jan. - Jun. 1976

Jul. 1976 61 p refs
 (Grants NGR-36-008-204; NGL-36-008-093; OSURF Proj. 3820-A1; OSURF Proj. 2514) (NASA-CR-148326; SASR-6; SASR-18) Avail: NTIS CSCL 08E

Various technical objectives, research and data analysis are presented for utilization in the Earth and Ocean Physics Applications Program and the National Geodetic Satellite Program. The subjects discussed are: (1) theoretical investigations related to Doppler observations, (2) geodetic network distortions from satellite observations, (3) earth rotation and plate motions, (4) the orientation of the earth from laser ranging, (5) monitoring of crustal movements in the San Andreas Fault zone by a satellite-borne ranging system, (6) optimum geometric utilization of LAGEOS, (7) LAGEOS validation plan, and (8) optimal design of the VLBI experiment. Lastly reference is made to further efforts in the continuing programs.

L.S.

N76-27619*# Naples Univ. (Italy).

LAND SLIDES INVESTIGATION IN SOUTHERN ITALY (ARDUO PROJECT)

Luigi G. Napolitano, Principal Investigator [1975] 6 p Sponsored by NASA ERTS (E76-10368; NASA-CR-147960) Avail: NTIS HC \$3.50 CSCL 08M

N76-27655# Oak Ridge National Lab. Tenn.

ASSIGNMENTS OF ERTS AND TOPOGRAPHICAL DATA TO GEODETIC GRIDS FOR ENVIRONMENTAL ANALYSIS OF CONTOUR STRIP MINING

R. C. Durfee and R. G. Edwards 1975 55 p refs Presented at the Intern. Symp. on Land Use, Phoenix, Ariz., 27 Oct. 1975 Sponsored by ERDA (Conf-751074-1) Avail: NTIS HC \$5.50

Computer techniques are presented for converting ERTS classified landcover patterns, Defense Mapping Agency topographic data, and geographical variables from other sources onto a common geodetic grid composed of latitude-longitude cells. Spatial analysis techniques are then used to assess the environmental and aesthetic impact of coal surface mining in the New River basin of East Tennessee.

Author (ERA)

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GEOLOGY AND MINERAL RESOURCES

Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.

A76-29449 # Investigation of the characteristics of formation of large-scale geological and geomorphological structures from satellite photographic images (Issledovanie zakonomernosti formirovaniia krupnomasshtabnykh geolog-geomorfologicheskikh struktur po kosmicheskim fotoizobrazheniiam). M. Nazirov (Glavnoe Upravlenie Gidrometeorologicheskoi Sluzhby SSSR, Gidrometeorologicheskii Nauchno-Issledovatel'skii Tsentr, Moscow, USSR). *Geodeziia i Aerofotos'emka*, no. 4, 1975, p. 67-75. In Russian.

In his report 'Synoptic geology or satellites for planetary geology', Nazarov (1972) pointed out that the vortex-like structure and similarity with atmospheric cloud vortices of some large-scale structures in the lithosphere may imply a 'circulatory' origin of these structures. A 'lithospheric vortex' was discussed whose circulation may have encompassed the giant mountain ranges in south-west Asia. In the present paper, some features are identified which are seen to confirm the circulatory nature of the formation of some basic structural characteristics of the islands in the north-west Pacific and some other terrestrial regions. V.P.

A76-29917 Investigations in the ionosphere on Kosmos 378. IV - Structure of regions where electrons with energies 0.5-12 keV and their convection are recorded. V - Anisotropy of electron fluxes of 0.5-12 keV at high latitudes. M. Z. Khokhlov (Akademiia Nauk SSSR, Institut Kosmicheskikh Issledovani, Moscow, USSR). (*Geomagnetizm i Aeronomiia*, vol. 15, Mar.-Apr. 1975, p. 207-220.) *Geomagnetism and Aeronomy*, vol. 15, Sept. 1975, p. 173-182. 54 refs. Translation.

A76-30312 # Optical-radiation extinction and image quality during geodetic observations in a turbulent atmosphere (Ob oslablenii opticheskogo izlucheniia i o kachestve izobrazhenii pri geodezicheskikh nabludeniiax v turbulentnoi atmosfere). D. D. Dziaman. *Kazanskaia Gorodskaiia Astronomicheskaiia Observatoriia, Trudy*, no. 40, 1974, p. 136-145. 11 refs. In Russian.

A76-31446 # Example applications of remote sensing methods in geology (Anwendungsbeispiele von Fernerkundungsverfahren in der Geologie). R. Günther (Clausthal, Technische Universität, Clausthal-Zellerfeld, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 311-327. 9 refs. In German.

The application of earth survey methods within the international Upper Mantle Project is demonstrated by three examples. These are a lithological and structural survey of the Afar Depression in Ethiopia; a demonstration of the photolineation technique applied to several areas in Germany; and the application of a radiometer to the investigation of a geothermal anomaly. V.P.

A76-31447 # Geological information from satellite imagery and aerial photography - Experience from the research project Tibesti mountains /NASA Landsat-1 SR-349/ (Geologische Information im Satellitenbild und Luftbild - Erfahrungen aus dem For-

schungsprojekt Tibesti-Gebirge /NASA Landsat-1 SR-349/). F. K. List, D. Helmcke, and N. W. Roland (Berlin, Freie Universität, Berlin, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 329-344. 18 refs. In German.

The potential and limits of satellite imagery, as compared with aerial photography and conventional landscape studies, are evaluated on the basis of regional geological surveys of the Tibesti mountain range. Visual interpretation of Tibesti from Landsat-1 images is seen to provide valuable additional information that supplements the data obtained from aerial photographs and land surveys. Purely visual interpretation, however, yields only a fraction of the information available from images and stored on magnetic tape. The need for digital evaluation is indicated. V.P.

A76-31623 * The Igwisi Hills extrusive 'kimberlites'. A. M. Reid (NASA, Johnson Space Center, Houston, Tex.), C. H. Donaldson (Lunar Science Institute, Houston, Tex.), J. B. Dawson (St. Andrews, University, St. Andrews, Scotland), R. W. Brown (Lockheed Electronics Co., Inc., Houston, Tex.), and W. I. Ridley (Lamont-Doherty Geological Observatory, Palisades, N.Y.). In: Physics and chemistry of the earth. Volume 9. Oxford and New York, Pergamon Press, 1975, p. 199-218. 22 refs. Research supported by the Natural Environment Research Council of England; Contract No. NSR-09-051-001.

The petrography and mineral chemistry of volcanic rocks from the Igwisi Hills in Tanzania are discussed. There is considerable evidence to suggest that the Igwisi rocks are extrusive kimberlites: a two-component nature with high P-T minerals in a low P-T matrix; the presence of chrome pyrope, Al enstatite, chrome diopside, chromite and olivine; a highly oxidized, volatile-rich matrix with serpentine, calcite, magnetite, perovskite; high Sr, Zr, and Nb contents; occurrence in a narrow isolated vent within a stable shield area. The Igwisi rocks differ from kimberlite in the lack of magnesium ilmenite, the scarcity of matrix phlogopite, and the overall low alkali content. They apparently contain material from phlogopite-bearing garnet peridotites with a primary mineral assemblage indicative of equilibrium at upper mantle temperatures and pressures. This primary assemblage was brought rapidly to the surface in a gas-charged, carbonate-rich fluid. Rapid upward transport, extrusion, and rapid cooling have tended to prevent reaction between inclusions and the carbonate-rich matrix that might otherwise have yielded a more typical kimberlite. C.K.D.

A76-31624 * Lithophile trace element data bearing on the origin of peridotite xenoliths, ankaramite and carbonatite from Lashaine volcano, N. Tanzania. W. I. Ridley (Lunar Science Institute, Houston, Tex.) and J. B. Dawson (St. Andrews, University, St. Andrews, Scotland). In: Physics and chemistry of the earth. Volume 9. Oxford and New York, Pergamon Press, 1975, p. 559-569. 23 refs. Contract No. NSR-09-051-001.

A76-33217 * # Comparison of geological information from satellite imagery, aerial photography, and ground investigations in the Tibesti Mountains, Chad. F. K. List, N. W. Roland, and D. Helmcke (Berlin, Freie Universität, Berlin, West Germany). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 543-553. 15 refs. Research supported by the Deutsche Forschungsgemeinschaft and Freie Universität Berlin; Contract No. NASr-349.

A76-33416 * Nd isotopic variations and petrogenetic models. D. J. DePaolo and G. J. Wassenburg (California Institute of Technology, Pasadena, Calif.). *Geophysical Research Letters*, vol. 3, May 1976, p. 249-252. 27 refs. NSF Grant No. NPS-71-02670-A05; Grant No. NGL-05-002-188.

04 GEOLOGY AND MINERAL RESOURCES

The isotopic composition of Nd in selected terrestrial rocks is investigated to gain information about its implications for petrogenesis and the history of the earth's crust and mantle. Chemical and mass-spectrometric measurements of the Nd-143/Nd-144 ratio in terrestrial rocks of different ages show that the Sm/Nd ratio and the rare-earth-element (REE) abundance pattern are equal within a few per cent to those of chondritic meteorites. Variations in the Nd isotopic ratio in young basalts are found to permit the identification of distinctive mantle sources and to indicate the preservation of significant heterogeneities in the mantle for times of 1 to 4 billion years ago. The isotopic data also show that mantle source regions with a Sm/Nd ratio which differs from the chondritic value by a factor of two are not preserved for more than a few hundred million years. The average continental crust material is found to have a much lower isotopic ratio than the mantle, reflecting the crust's low Sm/Nd ratio resulting from REE fractionation during crust formation from the mantle. F.G.M.

A76-35080 # Place and significance of radar survey in the complex of remote sensing methods used in the USSR for study of environment. V. B. Komarov and V. A. Starostin (Ministry of Geology of the USSR, Laboratory of Aeromethods, Leningrad, USSR). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 825-834. 18 refs.

The paper reviews the use of side-looking airborne radar for remote sensing purposes in the Soviet Union, with particular emphasis on its application for geological surveys, ice detection, water pollution monitoring, soil and crop studies, and hydrological surveys. It is argued that radar remote sensing serves as a transition from aerial photography to satellite-borne remote sensing. The use of radar data in conjunction with high-altitude aerial data and satellite data is discussed as is the combined use of radar, photographic, and aerial infrared imagery of the same geographical area. B.J.

A76-35088 # Some results obtained by applying remote sensing in exploration of mineralized zones in Yugoslavia. J. Koscec, B. Koscec, M. Denih, and M. Knapp (Industroprojekt, Zagreb, Yugoslavia). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 911-914.

A76-35089 # Geological interpretation of the ERTS-1 satellite imagery of Lesotho, and possible relations between lineaments and kimberlite pipe emplacement. R. Barthélemy and A. Dempster (Department of Mines and Geology, Maseru, Lesotho). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 915-924. 19 refs.

Landsat composite imagery on a scale of 1:1,000,000 was analyzed to detect geological features of possible economic interest in Lesotho. Linear formations (lineaments) such as large dikes, joints, and faults could be detected in basalt and sandstones in addition to alignments of drainage patterns and topographic forms. Correlation of features in the satellite imagery with known kimberlite occurrences indicates that kimberlite pipe emplacement in Lesotho and South Africa may be influenced by the interrelationship of three lineaments trends; west northwest to east southeast (110-130 deg), southwest (50 deg), and north northwest (160-170 deg). It is recommended that kimberlite exploration be directed to the intersections of these trends, particularly when these intersections correspond with synclinal structures. It is noted that high-altitude swamps, appearing as light blue spots in satellite imagery, may conceal kimberlite pipes. C.K.D.

A76-35091 # Geologic interpretation of Landsat-1 imagery of the greater part of the Michigan Basin. B. Drake (Michigan, Environmental Research Institute, Ann Arbor, Mich.) and R. K. Vincent (Geospectra Corp., Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 933-948. 20 refs.

Photogeologic interpretation techniques are used to study with the unaided eye a 1:500,000 scale mosaic of Michigan constructed from Landsat-1 false color composites obtained in early June of spring 1973. Emphasis is placed on geologic outline of the Michigan Basin, correlation between land use and geologic features, glacial deposits and features discriminated on the Landsat-1 mosaic, differentiation of recent geologic features, Precambrian and Phanerozoic bedrock patterns, and other pertinent structural characteristics. Five prominent elliptical features seen on the mosaic overlie positive gravity anomalies and locally coincident positive magnetic anomalies. The Landsat-1 mosaic provides a great opportunity to discriminate Wisconsin glacial deposits and features, to ensure new information about the glacial drainage channels, to obtain regional lineament patterns, and to revise the glacial map of the Southern Peninsula. S.D.

A76-35092 # Mapping in the Craters of the Moon volcanic field, Idaho with Landsat /ERTS/ imagery. R. H. Lefebvre. In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 951-963. 13 refs. Research supported by the U.S. Geological Survey and Grand Valley State College.

The Craters of the Moon (COM) lava flows are among the most recent eruptions of basaltic lavas that have occurred in the Snake River Plain area. The COM lava flows show significant variability in radiance on Landsat (ERTS) images. Preliminary mapping using Landsat imagery together with analysis of aerial photographs and field observations reveal that the radiance variations of the flows are due mainly to surface roughness, surface chemistry and mineralogy, and surface cover. Surface roughness allows discrimination between aa and pahoehoe flows, whereas surface chemistry and mineralogy and surface cover permit delineation of different age pahoehoe flows. It is shown that digital processing of Landsat images of basaltic lava flows in arid to semiarid regions provides a broad regional and multispectral perspective for geologic mapping. Landsat imagery can be used to give a detailed mapping of several flows that are in juxtaposition, and the outer contact of the volcanic field with the older Snake River Plain lavas can be mapped with confidence. S.D.

A76-35093 # Lineaments and tectonism in the northern part of the Mississippi embayment. D. O'Leary and S. Simpson (U.S. Geological Survey, Denver, Colo.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 965-973.

A study of Landsat images, SLAR image strips, and Skylab photographs reveals a tectonically significant landscape pattern at the northern end of the Mississippi embayment. Of chief geologic significance in the area are various structurally controlled, straight linear features. These features have a bearing on the alluvial part of the embayment, where structure is not observable at the surface. The lineament pattern indicates that this part of the embayment is dominated by block-faulted structures which have been surrounded and partly buried by Pleistocene sediments. Major lineaments intersect at the north end of the embayment, where a complex pattern of faulting is present; this pattern appears to control the landscape farther south and suggests that the embayment is an episodically opening, wedge-like feature. (Author)

A76-35095 * # Thermal inertia mapping. A. B. Kahle, A. R. Gillespie, A. F. H. Goetz, and J. D. Addington (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 985-994. 33 refs. Contract No. NAS7-100.

A thermal model of the earth's surface has been developed and used to determine the thermal inertia of a test site in the Mojave Desert, California. The model, which includes meteorological heating terms as well as radiation and conduction heating terms, is used with remotely sensed surface temperature data to determine thermal inertia of materials. The thermal inertia is displayed in image form, and can aid in the differentiation of the various lithologic materials in the test site. (Author)

A76-35098 # Correlation between ground metal analysis, vegetation reflectance, and ERTS brightness over a molybdenum skarn deposit, Pine Nut Mountains, western Nevada. R. J. P. Lyon (Stanford University, Stanford, Calif.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1031-1044. 11 refs.

A76-35099 # Correlation of Landsat-1 multispectral data with surface geochemistry. G. I. Ballew (Stanford University, Stanford, Calif.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1045-1055. 13 refs. Research supported by Stanford University.

Uncorrected Landsat multispectral scanner (MSS) digital data were compared with surface geochemical data from 126 soil and rock samples collected by the U.S. Geological Survey over a 15 sq km area in the north-central portion of the Virginia City 15-minute quadrangle, Nevada. The samples, taken predominantly from bleached andesite areas, were analyzed for Hg, Au, Ag, Pb, Cu, and Bi, and the concentrations and logs of the concentrations of each of these metals were correlated with the four MSS channels values, with the log of these values, and with the ratios of the channel values and the logs of these ratios. Multiple regression analyses indicate that the linear relationships with a probability greater than 0.90 exist for Hg, Pb, log Hg, log Pb, log Ag, and Bi content. A field investigation revealed some correspondence between predicted anomalies and mines and prospects. C.K.D.

A76-35100 # A regional mapping program and mineral resources survey based on remote sensing data. A. C. Corrêa (Instituto de Pesquisas Espaciais, São José dos Campos, São Paulo, Brazil). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1057-1065. 22 refs.

Landsat-1 data have been used to map the geological structure of the middle São Francisco River area in eastern Brazil on a scale of 1:1,000,000. Supplementary imagery from side-looking airborne radar imagery and aerial photographs were included when available. The findings of visual interpretations of the imagery were verified by reconnaissance field work. Structural features, particularly lineaments, showed clearly in the imagery and provided potentially useful indications of areas with possible mineralization. Lithologies could be identified with good reliability by tone and texture and by examination of associated drainage patterns, landforms, vegetation, and soil use patterns. C.K.D.

A76-35896 * Recent processed results from the Skylab S-192 multispectral scanner. F. J. Thomson, R. F. Nalepta, R. K. Vincent, and B. C. Salmon. *Journal of the Astronautical Sciences*, vol. 23, July-Sept. 1975, p. 193-203. Contracts No. NAS9-13386; No. NAS9-13317.

Results of mapping of rock types from the White Sands, New Mexico area using digital tape data from the Skylab S-192 multispectral scanner are presented. Spectral recognition techniques were used to process the geological data and signatures were extracted from the training sets using a set of promising ratio features defined by analysis of ERSIS (Earth Resources Spectral Information System). An analysis of ERSIS spectra of rock types yielded 24 promising spectral channel ratio features for separating the rock types into precambrian, calcareous, and clay materials and those containing ferric iron. B.J.

A76-36075 Tectonic directions remotely sensed by side-looking airborne radar in the Chaudes-Aigues region /Cantal, France/ (Directions tectoniques télédéetectées par radar latéral aéroporté dans la région de Chaudes-Aigues /Cantal, France/). J.-P. Gibert (Paris XI, Université, Orsay, Essonne, France) and S. Paul (Paris VIII, Université, Paris, France). *Photogrammetria*, vol. 32, Mar. 1976, p. 15-24. 15 refs. In French.

Side-looking airborne radar was used to remotely sense the southeastern part of the Massif of Cantal which includes volcanic, crystalline and metamorphic formations and the site of the emergence of hyperthermal water at Chaudes-Aigues. A photographic visualization of the radar record is presented along with statistical polar diagrams of directions of alignments measured on the interpretative map and of directions of vein cheeks and of slickensides near Chaudes-Aigues. B.J.

A76-37261 Radar imagery in defining regional tectonic structure. T. A. Grant and L. S. Cluff (Woodward-Clyde Consultants, San Francisco, Calif.). In: Annual review of earth and planetary sciences. Volume 4. Palo Alto, Calif., Annual Reviews, Inc., 1976, p. 123-145. 23 refs.

Topographic imagery using side-looking airborne radar (SLAR) is described and compared with photographic imaging approaches. Differences in types of detail enhanced or suppressed in SLAR imagery are pointed out. SLAR mosaics cover areas 100 to 200 sq km in extent, and SLAR constitutes an active system capable of operation around the clock, with clear skies or cloud cover. Radar foreshortening, layover, and shadowing are discussed, and real and synthetic apertures are compared. Examples of SLAR images of joints, fractures, faults, dikes, and other large-scale topographic features are displayed, and high-altitude low-sun-angle photographic imagery is compared. R.D.V.

A76-38108 # Benefits of remote sensing systems to petroleum operations in Canadian ice-infested waters. A. K. McQuillan (Canada Centre for Remote Sensing, Ottawa, Canada) and D. J. Clough (Waterloo, University, Waterloo, Ontario, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 109-120. 18 refs.

A76-38110 # Enhancing of geological definition in Landsat data. J. E. Robinson and S. Carroll (Union Oil Company of Canada, Ltd., Calgary, Alberta, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 145-153. 20 refs. Research supported by the Union Oil Company of Canada.

Limitations on the usefulness of mathematical and computer-aided classification and enhancement of Landsat type survey data for geological assessment are discussed. Reflectance variations caused by weathering, haze, and diffuse energy, and failure of reflectance contours to reveal bedrock patterns or low-grade contents of

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resources of economic interest, are discussed extensively. Automatic classification of shape, pattern, structure, and reflectance is deemed not practical at present, and techniques should be employed such that a competent geologist can best interpret the composition and structure of the lithological surface displayed. Use of density slicers, zoom transfer scopes, and other inexpensive optical devices, and application of filtering and spline interpolations to the data are recommended. R.D.V.

A76-38115 # Physical geology using aerial photographs, Banff and Jasper national parks. T. H. F. Reimchen (Bayrock and Reimchen Surficial Geology, Ltd., Vancouver, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 227-232.

N76-22619*# Central Treaty Organization, Ankara (Turkey). **REGIONAL INVESTIGATION OF TECTONIC AND IGNEOUS GEOLOGY IN IRAN, PAKISTAN AND TURKEY** Quarterly Report

Morris Crawford, Principal Investigator 29 Jan. 1976 28 p refs Sponsored by NASA ERTS (E76-10297; NASA-CR-146787; EC/24/M/D10; QR-1) Avail: NTIS HC \$4.00 CSCL 08G

N76-22644# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.

GEOMAGNETIC MEASUREMENTS OF BASALT OCCURRENCE IN SALT STOCK AT ROLFSBUETTEL [GEOMAGNETISCHE MESSUNGEN AM BASALTVORKOMMEN DES SALZSTOCKES VON ROLFSBUETTEL]

K. H. Nauwald and U. Hunsche 1975 51 p refs In GERMAN

(GAMMA-27) Avail: NTIS HC \$4.50

Measurements were carried out of geomagnetic field anomalies above a foreign body embedded in a salt stock near Rolfsbuettel (Germany). The result is an extended, closed, north-south, positive anomaly between two basalt drill holes, indicating a basalt duct at an average maximum depth of 55 m. Model calculations confirm the results of the measurements.

ESA

N76-22824# Lamont-Doherty Geological Observatory, Palisades, N.Y.

IN-SITU STRESS MEASUREMENT PROGRAM-FIELD RESULTS. DETERMINATION OF THE REGIONAL STRESS FIELD IN NEW YORK STATE AND ADJACENT AREAS BY IN-SITU STRAIN RELIEF MEASUREMENTS Technical Report, 1 Feb. - 31 Aug. 1975

Marc L. Sbar, Terry Engelder, and Warren Prell 1975 62 p refs Sponsored by New York State Energy Res. and Develop. Authority (PB-248538/1; NYSEDA-75/10). Avail: NTIS HC \$4.50 CSCL 08K

The mapping of stress orientations and magnitudes in rock outcrops to identify domains of uniform stress were studied. These uniform stress domains help to redefine uniform stress field domains in rock outcrops of tectonic provinces, and are applicable to the problems of earthquake hazard analysis. An overcoring technique to obtain and evaluate the significance of strain-relief measurements over a relatively large region of New York was used. The technique used, the sites occupied, the rationale for their selection and some preliminary observations are discussed.

GRA

N76-23643*# Alaska Univ., Fairbanks.

TECTONIC STRUCTURE OF ALASKA AS EVIDENCED BY ERTS IMAGERY AND ONGOING SEISMICITY Progress Report

Larry D. Gedney, Principal Investigator 5 May 1976 13 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (Contract NAS5-20802)

(E76-10316; NASA-CR-146827) Avail: NTIS HC \$3.50 CSCL 08G

N76-23647*# Missouri Univ., Rolla.

STRUCTURAL AND GROUND PATTERN ANALYSIS OF MISSOURI AND THE OZARK DOME USING LANDSAT-2 SATELLITE IMAGERY Progress Report

Geza Kisvarsanyi and Eva B. Kisvarsanyi, Principal Investigators (Geological Survey, Rolla, Mo.) 30 Apr. 1976 12 p refs ERTS

(Contract NAS5-20937)

(E76-10320; NASA-CR-147202; PR-3) Avail: NTIS HC \$3.50 CSCL 08F

N76-23649*# Martin Marietta Corp., Denver, Colo.

EREP GEOTHERMAL Final Report

E. W. Johnston, Principal Investigator, A. L. Dunklee, and D. C. Wychgram 9 Aug. 1974 72 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(Contract NAS8-24000)

(E76-10322; NASA-CR-147655; MSC-05538) Avail: NTIS HC \$4.50 CSCL 10B

The author has identified the following significant results. A reasonably good agreement was found for the radiometric temperatures calculated from the ground truth data and the radiometric temperatures measured by the S192 scanner. This study showed that the S192 scanner data could be used to create good thermal images, particularly with the x-5 detector array.

N76-23660*# Consiglio Nazionale delle Ricerche, Milan (Italy). Istituto per la Geofisica della Litosfera.

RESULTS OF SKYLAB INVESTIGATION OVER ITALY Final Report

R. Cassinis, G. M. Lechi, and A. M. Tonelli, Principal Investigators 23 Dec. 1975 107 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(E76-10335; NASA-CR-147396) Avail: NTIS HC \$5.50

The author has identified the following significant results. Multispectral high resolution photography of S190A was successfully applied to the detection of paleoriverbeds in flat lands. Results of SL-3 mission were compared to those of LANDSAT for two regional geological surveys (linear structures) on the islands of Sicily and Sardinia. On Sicily, the seasonal conditions were unfavorable for Skylab while LANDSAT played a major role in discovering long, unknown lineaments of great interest for the geodynamics of the area. On Sardinia, owing to the vegetation type and to the geomorphic conditions, the Skylab imagery was successfully employed to describe the network of linears, both regional and local. Results can be used to study the relationship between linears, actual fracturing and the occurrence of mineral deposits.

N76-23662*# California Earth Science Corp., Santa Monica. **FAULT TECTONICS AND EARTHQUAKE HAZARDS IN PARTS OF SOUTHERN CALIFORNIA** Final Report, 23 May 1973 - 31 Jan. 1976

P. M. Merifield, Principal Investigator, D. L. Lamar, Carl Gazley, Jr. (RAND Corp., Santa Monica, Calif.), J. V. Lamar (RAND Corp., Santa Monica, Calif.), and R. H. Stratton (RAND Corp., Santa Monica, Calif.) Jan. 1976 184 p refs Original contains

imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(Contract NAS2-7698)

(E76-10337; NASA-CR-144477) Avail: NTIS HC \$7.50 CSCL 08G

The author has identified the following significant results. Four previously unknown faults were discovered in basement terrane of the Peninsular Ranges. These have been named the San Ysidro Creek fault, Thing Valley fault, Canyon City fault, and Warren Canyon fault. In addition fault gouge and breccia were recognized along the San Diego River fault. Study of features on Skylab imagery and review of geologic and seismic data suggest that the risk of a damaging earthquake is greater along the northwestern portion of the Elsinore fault than along the southeastern portion. Physiographic indicators of active faulting along the Garlock fault, identifiable in Skylab imagery include scarps, linear ridges, shutter ridges, faceted ridges, linear valleys, undrained depressions and offset drainage. The following previously unrecognized fault segments are postulated for the Salton Trough Area: (1) An extension of a previously known fault in the San Andreas fault set located southeast of the Salton Sea; (2) An extension of the active San Jacinto fault zone along a tonal change in cultivated fields across Mexicali Valley (the tonal change may represent different soil conditions along opposite sides of a fault). For the Skylab and LANDSAT images studied, pseudocolor transformations offer no advantages over the original images in the recognition of faults in Skylab and LANDSAT images. Alluvial deposits of different ages, a marble unit and iron oxide gossans of the Mojave Mining District are more readily differentiated on images prepared from ratios of individual bands of the S-192 multispectral scanner data. The San Andreas fault was also made more distinct in the 8/2 and 9/2 band ratios by enhancement of vegetation differences on opposite sides of the fault. Preliminary analysis indicates a significant earth resources potential for the discrimination of soil and rock types, including mineral alteration zones. This application should be actively pursued.

N76-24654+ AMR/PREUSSAG A.G., Hannover (West Germany).

MANGANESE NODULES: A BIBLIOGRAPHY 1878 - 1975 [BIBLIOGRAPHIE DER MANGANKNOLLEN-LITERATUR 1878-1975]

Rainer M. A. Fellerer Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1975 123 p refs. In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. (BMFT-FB-M-75-03). Avail: NTIS HC \$5.50; ZLDI, Munich DM-25.45

A summary of publications is presented based mainly on the needs of the exploration activities which started 5 years ago; it includes nearly all the papers and reports of manganese nodules available, as well as selected publications of general importance for the exploration practice concerning the properties of environment (water column, sediment, topography) and the technical aspects of developing (exploration techniques, mining, metallurgy, economy, legal problems). A special classification code is used as an aid for orientation within the main topics.

Author (ESA)

N76-24656*# Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).

REGIONAL TECTONIC EVALUATION OF THE TUSCAN APENNINE, VULCANISM, THERMAL ANOMALIES AND THE RELATION TO STRUCTURAL UNITS Final Report, Oct. 1972 - May 1975

J. Bodechtel, Principal Investigator May 1975 146 p refs Sponsored by NASA and Deutsche Forschungsgemeinschaft Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10331; NASA-CR-147212) Avail: NTIS HC \$6.00 CSCL 08F

The author has identified the following significant results. The geological interpretation on data exhibiting the Italian peninsula led to the recognition of tectonic features which are explained by a clockwise rotation of various blocks along left-handed transform faults. These faults can be interpreted as resulting from shear due to main stress directed north-eastwards. A land use map of the mountainous regions of Italy was produced on a scale of 1:250,000. For the digital treatment of MSS-CCTs an image processing software was written in FORTRAN 4. The software package includes descriptive statistics and also classification algorithms.

N76-24665*# Wyoming Univ., Laramie. Dept. of Geology. **APPLICATION LANDSAT IMAGERY TO GEOLOGIC MAPPING IN THE ICE-FREE VALLEYS OF ANTARCTICA** Final Report, Jul. 1972 - Feb. 1976

Robert S. Houston, Principal Investigator, Ronald W. Marrs, and Scott B. Smithson Feb. 1976 73 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21818)

(E76-10345; NASA-CR-147237) Avail: NTIS HC \$4.50 CSCL 08G

The author has identified the following significant results. Studies in the Ice-Free Valleys are resulted in the compilation of a sizeable library of maps and publications. Rock reflectance measurements were taken during the Antarctic summer of 1973. Spectral reflectance of rocks (mostly mafic lava flows) in the McMurdo and Ice-Free Valleys areas were measured using a filter wheel photometer equipped to measure reflectances in the four Landsat bands. A series of samples were collected at regular intervals across a large differentiated, mafic sill near Lake Vida. Chemical analyses of the sample suggest that the tonal variations in this sill are controlled by changes in the iron content of the rock. False color images were prepared for a number of areas by the diazo method and with an optical multispectral biviwer. These images were useful in defining boundaries of sea ice, snow cover, and in the study of ablating glaciers, but were not very useful for rock discrimination.

N76-24672*# Department of Surveys and Lands, Gaborone (Botswana).

AN AID TO THE DEVELOPMENT OF BOTSWANA'S RESOURCES Progress Report

William L. Dickson, Principal Investigator and J. A. Raffle Apr. 1976 8 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10352; NASA-CR-147244; QPR-1) Avail: NTIS HC \$3.50 CSCL 05B

N76-24675*# Academy of Scientific Research and Technology, Cairo (Egypt).

REGIONAL PROSPECTING FOR IRON ORES IN BAHARIYA OASIS-EL FAIYUM AREA, EGYPT, USING LANDSAT SATELLITE IMAGES, PART 1

M. A. Abdel-Hady, Principal Investigator, E. M. El Shazly, M. A. El Ghawaby, and S. M. Khawasik 29 Feb. 1976 56 p refs Sponsored by NASA ERTS

(E76-10355; NASA-CR-147247) Avail: NTIS HC \$4.50 CSCL 08G

N76-24676*# Academy of Scientific Research and Technology, Cairo (Egypt).

GEOLOGICAL AND ENVIRONMENTAL RESOURCES INVESTIGATIONS IN EGYPT USING LANDSAT IMAGES Progress Report

M. A. Abdel-Hady, Principal Investigator [1975] 16 p refs

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Sponsored by NASA ERTS
(E76-10356; NASA-CR-147248; QPR-1) Avail: NTIS
HC \$3.50 CSCL 08G

N76-24877* Servicio Geologico de Bolivia, La Paz.
**THE 29950 EARTH RESOURCE TECHNOLOGY SATELLITE
(ERTS-A) SENSOR DATA FOR MINERAL RESOURCE
SECTOR DEVELOPMENT AND REGIONAL LAND USE
SURVEY** Quarterly Report, Nov. 1975 - Mar. 1976
Carlos E. Brockmann, Principal Investigator Mar. 1976 15 p
Sponsored by NASA Original contains color illustrations ERTS
(E76-10357; NASA-CR-147915) Avail: NTIS HC \$3.50 CSCL
08G

N76-24684* Pennsylvania Univ., Philadelphia. Dept. of
Geology.
**MICROPROBE AND OXYGEN FUGACITY STUDY OF
ARMALCOLITE** Final Technical Report
John J. Friel 14 Jun. 1976 33 p refs
(Grant NsG-7119)
(NASA-CR-148134) Avail: NTIS HC \$4.00 CSCL 08G

The stability of synthetic armalcolite was determined as a function of oxygen fugacity with particular regard to the oxidation state of iron and titanium. The equilibrium pseudobrookite (armalcolite) composition was measured at 1200 C under various conditions of oxidation typical of the lunar environment. These data, when compared with published descriptions of mare basalts, provide information about the conditions of crystallization of armalcolite-bearing lunar rocks. Some information about the crystal chemistry of armalcolite was obtained from X-ray diffraction and electron microprobe analyses of synthetic armalcolite and Zr-armalcolite. Further data were gathered from a comparison of the Mossbauer spectra of a phase pure stoichiometric armalcolite and one containing appreciable amounts of trivalent titanium. Author

N76-24691* Cincinnati Univ., Ohio.
**FACTORS AFFECTING DEVELOPMENT, AND OPTIMAL
PHOTOMAPPING TECHNIQUE, OF CALCIUM CARBONATE
CEMENTATION OF ARID REGION SEDIMENTS** Final
Report, Jul. 1971 - Sep. 1975
Laurence H. Lattman 6 Oct. 1975 30 p refs
(Grant DA-ARO(D)-31-124-71-G137)
(AD-A018959; ARO-9876.2-G5) Avail: NTIS CSCL 08/7

Caliche (secondary calcium carbonate cementation) occurs as six different types in southern Nevada. Two of these types, petrocalcic horizons and laminar layers, markedly reduce infiltration on alluvial fans and increase flooding hazards. The most important factor apparently controlling development of caliche in the southwestern United States is the lithology of the alluvial fan detritus. Availability of eolian dust, containing calcite and gypsum, and increasing age of the deposit are factors which increase calichification. The thickest caliche deposits are adjacent to or downwind from gypsum outcrops. Using black-and-white film and filter combinations it was found that an orange filter gave the most reliable results in distinguishing calichified from non-calichified fans. A blue filter gave greatest contrast between calichified fan surfaces and uncalichified modern drainage washes. Because of variation in caliche types, no clear correlation was found between degree of calichification and photographic expression. GRA

N76-25615* Wyoming Univ., Laramie. Dept. of Geology.
MULTIDISCIPLINARY STUDY ON WYOMING TEST SITES
Final Report
R. S. Houston, Principal Investigator, R. W. Marrs, and L. E. Borgman Dec. 1975 219 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(Contract NAS9-13298)
(E76-10369; NASA-CR-147719) Avail: NTIS HC \$7.75 CSCL
08F

The author has identified the following significant results. Ten EREP data passes over the Wyoming test site provided excellent S190A and S190B coverage and some useful S192 imagery. These data were employed in an evaluation of the EREP imaging sensors in several earth resources applications. Boysen Reservoir and Hyattville were test areas for band to band comparison of the S190 and S192 sensors and for evaluation of the image data for geologic mapping. Contrast measurements were made from the S192 image data for typical sequence of sedimentary rocks. Histograms compiled from these measurements show that near infrared S192 bands provide the greatest amount of contrast between geologic units. Comparison was also made between LANDSAT imagery and S190B and aerial photography for regional land use mapping. The S190B photography was found far superior to the color composite LANDSAT imagery and was almost as effective as the 1:120,000 scale aerial photography. A map of linear elements prepared from LANDSAT and EREP imagery of the southwestern Bighorn Mountains provided an important aid in defining the relationship between fracture and ground water movement through the Madison aquifer.

N76-25617* Helsinki Univ. (Finland). Dept. of Geology.
**INVESTIGATION OF LANDSAT IMAGERY ON CORRELA-
TIONS BETWEEN ORE DEPOSITS AND MAJOR SHIELD
STRUCTURES IN FINLAND** Quarterly Progress Report,
Oct. - Dec. 1976
Heikki V. Tuominen, Principal Investigator and Viljo Kuosmanen
Dec. 1975 17 p refs Sponsored by NASA ERTS
(E76-10372; NASA-CR-147965) Avail: NTIS HC \$3.50 CSCL
08G

The author has identified the following significant results. On the central Baltic Shield, the concept of drainage patterns can be extended to smaller scales in which case many cultural features become involved to the spatial patterns influenced by bedrock structure. Features resulting from agriculture activity and timbering often exaggerate the influence of the bedrock on the image texture.

N76-25645 Geological Survey, Austin, Tex. Water Resources
Div.
**BIBLIOGRAPHY OF UNITED STATES GEOLOGICAL
SURVEY REPORTS ON THE GEOLOGY AND WATER
RESOURCES OF TEXAS 1887 - 1974** Final Report
Charlotte D. Friebele Oct. 1975 179 p refs
(PB-248926/8; USGS-WRD-76-002; USGS-WRI-20-75) Avail:
NTIS HC \$7.50 CSCL 08H

A bibliographic list of reports is presented that was prepared by the U.S. Geological Survey from 1887 through 1974 on the geology and water resources of Texas. In addition to the bibliographic list, the reports are indexed by county, hydrologic area, and subject matter. Author

N76-25648* National Oceanic and Atmospheric Administration,
Rockville, Md. Office of Coastal Zone Management.
**COASTAL MANAGEMENT ASPECTS OF OCS OIL AND GAS
DEVELOPMENTS** Technical Information Paper
Edward T. Laroe, Paul R. Stang, Katharine H. Conroy, David W. Laist, and Trevor Q. Neill Jan. 1975 90 p refs
(PB-249751/9; NOAA-76011504) Avail: NTIS HC \$5.00 CSCL
08I

This report provides a brief overview of Outer Continental Shelf (OCS) petroleum activities and a description of: Federal OCS responsibilities and roles, offshore and onshore activities associated with OCS operations, socioeconomic and environmental impacts deriving from those activities and suggestions for planning and management for OCS developments. The annotated bibliography describes the OCS-related portions of the literature cited. A directory of agencies and organizations involved with OCS oil and gas related activities is included. GRA

N76-25649# Bureau of Mines, Denver, Colo. Intermountain Field Operation Center.

THE RESERVE BASE OF US COALS BY SULFUR CONTENT PART 2: THE WESTERN STATES

Patrick A. Hamilton, D. H. White, Jr., and Thomas K. Matson Nov. 1975 329 p. refs

(PB-249702/2; BM-IC-8693-Pt-2) Avail: NTIS CSCL 081

The coal reserve base of anthracite, bituminous, and subbituminous coals, and lignite is delineated by mining method and sulfur content, for coal-bearing states west of the Mississippi River. The reserve base of low-sulfur coal, = or < 1.0 percent sulfur is 167,324.5 million tons; medium-sulfur coal, 1.1 to 3.0 percent sulfur, is 37,529.2 million tons, and high-sulfur, > 3.0 percent sulfur, is 11,244.1 million tons. The reserve base of coal with an unknown sulfur content is 18,323.0 million tons. Resource and reserve definitions used were jointly defined by the U.S. Bureau of Mines and the U.S. Geological Survey. GRA

N76-26619# Central Treaty Organization, Ankara (Turkey). **GEOLOGICAL SURVEY OF IRAN Progress Report**

Eski B. M. M. Binasi, Principal Investigator [1975] 9 p Sponsored by NASA. ERTS

(E76-10391; NASA-CR-148178; PR-1) Avail: NTIS HC \$3.50 CSCL 08G

N76-26620# Central Treaty Organization, Ankara (Turkey). **REGIONAL INVESTIGATION OF TECTONIC AND IGNEOUS GEOLOGY IN IRAN, PAKISTAN AND TURKEY Quarterly Report, 1 Dec. 1975 - 29 Feb. 1976**

Eski B. M. M. Binasi, Principal Investigator 10 May 1976 10 p refs Sponsored by NASA ERTS

(E76-10392; NASA-CR-148179; QR-2) Avail: NTIS HC \$3.50 CSCL 08G

The author has identified the following significant results. It appears that the information gained from the imageries would result in revision of the existing tectonic maps of the region.

N76-26626# Earth Satellite Corp., Washington, D.C. **APPLICATION OF LANDSAT-2 DATA TO THE IMPLEMENTATION AND ENFORCEMENT OF THE PENNSYLVANIA SURFACE MINING CONSERVATION AND RECLAMATION ACT Progress Report, 19 Mar. - 19 Jun. 1976**

Orville R. Russell, Principal Investigator 19 Jun. 1976 5 p ERTS

(Contract NAS5-21998)

(E76-10398; NASA-CR-148185; C-1037-2-5;

Rept-21570-2-5) Avail: NTIS HC \$3.50 CSCL 081

N76-26628# Missouri Univ., Rolla. **STRUCTURAL LINEAMENTS AND MINERALIZATION IN SOUTHEAST MISSOURI Progress Report**

Geza Kisvarsanyi and Eva B. Kisvarsanyi, Principal Investigators (Geological Survey, Rolla, Mo.) 7 Jun. 1976 13 p refs ERTS

(Contract NAS5-20937)

(E76-10400; NASA-CR-148187) Avail: NTIS HC \$3.50 CSCL 05B

N76-26642# Chevron Oil Field Research Co., La Habra, Calif. **GEOLOGY, SUMMARY**

Floyd F. Sabins, Jr. In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 99-121 refs CSCL 08G

Trends in geologic application of remote sensing are identified. These trends are as follows: (1) increased applications of orbital imagery in fields such as engineering and environmental geology - some specific applications include recognition of active earthquake faults, site location for nuclear powerplants, and recognition of landslide hazards; (2) utilization of remote sensing by industry, especially oil and gas companies, and (3) application of digital image processing to mineral exploration. Author

N76-27622# Helsinki Univ. (Finland). Dept. of Geology. **INVESTIGATION OF LANDSAT IMAGERY ON CORRELATIONS BETWEEN ORE DEPOSITS AND MAJOR SHIELD STRUCTURES IN FINLAND Quarterly Progress Report, Jan. - Mar. 1976**

Heikki V. Tuominen, Principal Investigator Mar. 1976 13 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10390; NASA-CR-148204; QPR-3) Avail: NTIS HC \$3.50 CSCL 08G

The author has identified the following significant results. Half of the 24 lineaments found in the LANDSAT winter mosaic have not been recorded in earlier literature. Some distinct fracture zones of the basement seem not to be observable as lineaments in the LANDSAT imagery.

N76-27632# Instituto Geografico y Catastral, Madrid (Spain). **THEMATIC MAPPING, LAND USE, GEOLOGICAL STRUCTURE AND WATER RESOURCES IN CENTRAL SPAIN Quarterly Report**

Nunez DelasCuevas, Principal Investigator 15 May 1976 59 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10416; NASA-CR-148280; QR-2) Avail: NTIS HC \$4.50 CSCL 08B

N76-27633# Utah Univ., Salt Lake City. Dept. of Geophysics and Geology.

REMOTE SENSING IN MINERAL EXPLORATION FROM LANDSAT IMAGERY Quarterly Report, Jan. - Mar. 1976

L. H. Lattman, Principal Investigator 28 May 1976 30 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-20955)

(E76-10417; NASA-CR-148283; QR-4) Avail: NTIS HC \$4.00 CSCL 081

N76-27643# Agnew Tech-Tran, Inc., Woodland Hills, Calif. **OIL IN THE MOUTHS OF RIVERS**

N. I. Markovskiy Washington NASA Jun. 1976 22 p refs Transl. into ENGLISH from Priroda (USSR), no. 2, Feb. 1976 p 100-111

(Contract NASw-2789)

(NASA-TT-F-15462) Avail: NTIS HC \$3.50 CSCL 08G

The value of paleogeographic zoning in oil and gas exploration is discussed. The paleogeographic method is applied to oil and gas-bearing regions of Western Siberia to show the correlation between the location of large deposits and the sites of ancient seashores and estuaries. Productive oil and gas-bearing areas can be correlated with ancient deltas in the U.S.A. as well. Promising areas in the rest of the world are outlined. Author

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**N76-27645*# Kanner (Leo) Associates, Redwood City, Calif.
INDICES OF OIL-BEARING DEPOSITS AS BASED ON THE
FORMATION WATERS OF POLAND**

K. Schoenreich Washington NASA Jun. 1976 9 p Transl.
into ENGLISH from Nafta (Katowice), vol. 27, no. 4-6, 1971
p 154-157

(Contract NASw-2790)

(NASA-TT-F-17101) Avail: NTIS HC \$3.50 CSCL 08G

The frequency of occurrence of the I2, Cl:Br, SO4 and SO4:HCO3 indices was analyzed in water samples originating from oil-water interfaces and in barren samples originating in the regional hydrochemical background. The subject of the study were all analyses of Polish waters (about 1000) made during oil exploration. The prospective ranges which were determined for the indices were as follows: for I2 > 100 mg/l, for Cl:Br < 120, for SO4 < 0.07 g/l and for SO4:HCO3 < 2. The concept of an oil prospect coefficient was introduced, assigning to the corresponding indices numerical values, characterizing the probability of occurrence of crude oil accumulations. In the prospective ranges, the coefficients are greater than one, and in the unlikely ranges their values lie between zero and one.

Author

OCEANOGRAPHY AND MARINE RESOURCES

Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.

A76-31008 # Investigation of ice-formation processes from data of aircraft onboard measurements of the radio thermal emission (Issledovanie protsessov ledobrazovaniia po dannym izmerenii radioteplovogo izlucheniia s borta samoleta). E. A. Bepalova, Iu. I. Rabinovich, E. A. Sharkov, T. A. Shiriaeva, and V. S. Etkin (Akademiia Nauk SSSR, Institut Kosmicheskikh Issledovani, Moscow, USSR). *Meteorologiya i Gidrologiya*, Feb. 1976, p. 68-72. 5 refs. In Russian.

A high-sensitivity radiometer mounted on an IL 18 aircraft was used to measure the radio thermal emission from the frozen surface of the Caspian Sea. Measurements at the 3-cm wavelength made it possible to differentiate between the types of ice, to evaluate the ice thickness during the formation phase and the degree of ice cover, and to identify the onset of ice formation (which cannot be determined visually from aerial photographs). The data obtained are used to plot a detailed ice chart and to study the evolution of the ice cover. V.P.

A76-31458 # Experience in the introduction of remote sensing techniques in oceanography (Erfahrungen über den Einsatz von Fernerkundungsverfahren in der Ozeanographie). K. Strübing (Deutsches hydrographisches Institut, Hamburg, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, Apr. 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 469-479. 12 refs. In German.

The dynamic interference by the constantly varying ocean surface with measurements, the need for 4-dimensional measurements, and the near-impossibility of considering ocean-surface parameters in isolation are discussed in relation to probing of the ocean-atmosphere interface by infrared, visual remote color spectrography and other visual techniques, side-looking radar and other microwave techniques, and sensing instruments carried by survey aircraft and satellites. The roughness of seas, wind velocity, water salt content, presence of oil slicks, flotsam and jetsam, surface temperature, presence of phytoplankton and algae and their effect on light propagation and the visual spectrum, the use of dye tracers, and effects of ice formations are considered. Information garnered by remote-sensing techniques is useful for navigation, the fishing industry, pollution control, and oceanographic research. R.D.V.

A76-31459 # Experience with remote sensing techniques for questions regarding coastal waters (Erfahrungen mit Methoden der Fernerkundung für Fragen der Küstengewässer). H. P. Bähr (Hannover, Technische Universität, Hanover, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, Apr. 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 481-487. In German.

The paper describes briefly some experiences in airborne and waterborne photographic, radiometric, and microdensitometer measurements of water pollution phenomena along the German North Sea coast. Geometric correlations by photogrammetry techniques proved useful in plotting the progress of an oil slick. Radiometric measurements were complicated by an additional disturbing signal caused by specular reflection and continuous foam particles. To obviate these problems, microdensitometer measurements were

carried out in color photographs with various filters. The greatest contrast between different water masses was found generally between 550 nm (green) and 620 nm (red). P.T.H.

A76-31479 Application of radar and microwave scattering to ocean wave research. J. W. Wright (U.S. Navy, Naval Research Laboratory, Washington, D.C.). In: Technology for the new horizon; Proceedings of the Thirteenth Space Congress, Cocoa Beach, Fla., April 7-9, 1976. Cocoa Beach, Fla., Canaveral Council of Technical Societies, 1976, p. 3-1 to 3-5. 13 refs.

The use of the Bragg and two-scale scattering of radar to measure the structure and properties of ocean waves is discussed. In the case of first-order Bragg scattering, the scattered electromagnetic field is proportional to the surface displacement. Thus the influence of all waves outside a narrow window at the Bragg resonance is strongly filtered out. This makes possible the measurement of such wave properties as temporal growth and approach in wind-wave tanks and spectral energy transfer in wave tanks or at sea. Moreover, the Doppler shift is the frequency of the Bragg wave in first order scattering, which means that phase velocities may be used to measure surface currents and to probe the profile of the mean flow on both sides of the air-water interface. In the case of two-scale scattering, the smaller scale scatterers are advected about by the orbital motions of the large wave, distinct Doppler splittings are obliterated and the width of the Doppler spectrum is about the rms orbital speed of the wave system. B.J.

A76-31481 A study of oceanic internal waves using satellite imagery and ship data. J. R. Apel, H. M. Byrne, J. R. Proni, and R. L. Sellers (NOAA, Ocean Remote Sensing Laboratory, Miami, Fla.). In: Technology for the new horizon; Proceedings of the Thirteenth Space Congress, Cocoa Beach, Fla., April 7-9, 1976. (A76-31476 14-12) Cocoa Beach, Fla., Canaveral Council of Technical Societies, 1976, p. 3-21 to 3-25. 7 refs.

Surface manifestations of oceanic internal waves have been studied in ERTS-1 spacecraft data since 1972. The internal waves appear as periodic, intermittent variations in optical reflectivity and are visible from spacecraft, aircraft, and surface vehicles under certain circumstances. The ERTS data suggest that the source of the waves is semidiurnal and diurnal tidal action at the edge of the continental shelf. A study of the wave characteristic yields considerable insight into the physics of their excitation, propagation, and dissipation. Packets have been observed and the internal wave groups show an orderly variation in wavelength from front to rear of the packet, due to a combination of frequency dispersion and nonlinear amplitude effects. An oceanographic cruise was carried out in synchronism with two 18-day ERTS-1 cycles, and data were taken on temperature and density variations, acoustic echoes, and surface slicks accompanying the internal waves. (Author)

A76-31482 The study of ocean circulation from space. G. A. Maul (NOAA, Atlantic Oceanographic and Meteorological Laboratories, Miami, Fla.). In: Technology for the new horizon; Proceedings of the Thirteenth Space Congress, Cocoa Beach, Fla., April 7-9, 1976. Cocoa Beach, Fla., Canaveral Council of Technical Societies, 1976, p. 3-27 to 3-36. 21 refs.

Major ocean currents have surface manifestations that make them observable by spacecraft sensors. Under certain conditions, any one or a combination of the following may be used to identify the current's boundary: changes in sea surface temperature, salinity, color (diffuse), sea state (specular), sea surface topography, wave refraction patterns, and modifications to the lower atmosphere. Infrared sensors have been used most extensively to study ocean circulation; however, new instruments such as passive and active microwave sensors can sense temperature, salinity, sea state, and surface topography, and multispectral visible scanners and spectro-radiometers are providing new information on ocean color and sea

state. Man's role as an observer and photographer provides the highest spatial resolution to date for describing visible changes across boundaries as well as sea and swell patterns. (Author)

A76-32425 Extraction of oceanographic informations separately from atmospheric informations using space-multispectral imageries. K. Watanabe (Tokai University, Shimizu, Shizuoka, Japan). In: International Symposium on Space Technology and Science, 11th, Tokyo, Japan, June 30-July 4, 1975, Proceedings. Tokyo, AGNE Publishing, Inc., 1975, p. 909-913.

An image-masking technique has been developed to separate areas of turbid water from cloud covers, smog layers, and sunglint in Landsat-1 multispectral imagery. Due to the attenuation of reflected light during transmission through a water layer, oceanographic information can be extracted by image subtraction of the pattern in the MSS-7 bandpass (0.8-1.1 microns) from the MSS-4 or MSS-5 (0.5-0.6 and 0.6-0.7 microns, respectively) patterns by an appropriate optical or digital process. Results obtained for Osaka Bay are discussed. C.K.D.

A76-32430 * Reconnaissance of marine resources. K.-H. Szekielda (United Nations, Ocean Economics and Technology Office, New York, N.Y.), D. J. Suszkowski, and P. S. Tabor (Delaware, University, Newark, Del.). In: International Symposium on Space Technology and Science, 11th, Tokyo, Japan, June 30-July 4, 1975, Proceedings. Tokyo, AGNE Publishing, Inc., 1975, p. 943-948. 14 refs. Contract No. NAS9-13344.

A test area along the NW Coast of Africa was used during the Skylab mission to study the distribution of temperature and plankton. The S190B Earth Terrain Camera with a spectral film response of 0.4-0.7 micrometers allowed qualitative estimates of the distribution patterns of suspended material. Differentiation between inorganic particles and phytoplankton could be made by comparing the green band and the red band of the S190A Camera System. The pictorial display of data obtained from the S191 scanning radiometer in the 10-11 micrometer atmospheric window allowed a detailed interpretation of the temperature distribution in the area where cold upwelled water reaches the euphotic zone. The comparison between infrared data and the imageries taken simultaneously indicated the origin of the cold water as well as the pathway within the Canary current. A fish survey carried out almost simultaneously in the area, by echosounding, showed high correlation between the position of good fishing grounds and the distribution of plankton as detected by remote sensing detectors on Skylab. (Author)

A76-32550 Island barrier effects on sea state as revealed by a numerical wave model and DMSP satellite data. R. W. Fett and K. M. Rabe (U.S. Naval Postgraduate School, Monterey, Calif.). *Journal of Physical Oceanography*, vol. 6, May 1976, p. 324-334. 15 refs.

Island barrier effects on the state of the sea in the lee of islands have been studied by means of a numerical wave prediction model and by examination of data from sensors of the Defense Meteorological Satellite Program (DMSP), the Synchronous Meteorological Satellite (SMS), and the Earth Resources Technology Satellite (ERTS). Visual indications of calm areas in the lee of the Lesser Antilles, evidenced by a marked reduction in the satellite-observed sunglint at selected sun angles, are verified by the results from the numerical wave model; other lee reflective patterns correspond to areas of changed sea state. These results indicate that a reduction in the swell height, alteration of the period, and reorientation of the swell direction, in many instances long distances to the island's lee, are responsible for the satellite-observed reflective patterns noted. The additional phenomena of bow waves and wind-induced oceanographic eddies are also examined, and some evidence of their occurrence and detection is presented. (Author)

A76-32988 * # Skylab earth resources experiment package /EREP/ - Sea surface topography experiment. F. O. Vonbun, J. G. Marsh (NASA, Goddard Space Flight Center, Greenbelt, Md.), J. T. McGoogan, C. D. Leitao (NASA, Wallops Flight Center, Wallops Island, Va.), S. Vincent (Phoenix Corp., McClean, Va.), and W. T. Wells (Wolf Research and Development Corp., Riverdale, Md.). *Journal of Spacecraft and Rockets*, vol. 13, Apr. 1976, p. 248-250. 9 refs.

The S-193 Skylab radar altimeter was operated in a round-the-world pass on Jan. 31, 1974. The main purpose of this experiment was to test and 'measure' the variation of the sea surface topography using the Goddard Space Flight Center (GSFC) geoid model as a reference. This model is based upon 430,000 satellite and 25,000 ground gravity observations. Variations of the sea surface on the order of -40 to +60 m were observed along this pass. The 'computed' and 'measured' sea surfaces have an rms agreement on the order of 7 m. This is quite satisfactory, considering that this was the first time the sea surface has been observed directly over a distance of nearly 35,000 km and compared to a computed model. The Skylab orbit for this global pass was computed using the Goddard Earth Model (GEM 6) and S-band radar tracking data, resulting in an orbital height uncertainty of better than 5 m over one orbital period. (Author)

A76-33354 * Wave patterns across the North Atlantic on September 28, 1974, from airborne radar imagery. C. Elachi (California Institute of Technology, Jet Propulsion Laboratory, Space Sciences Div., Pasadena, Calif.). *Journal of Geophysical Research*, vol. 81, May 20, 1976, p. 2655, 2656. Contract No. NAS7-100.

Airborne coherent radar imagery taken during a cross-Atlantic flight was used to determine the two-dimensional wave pattern of waves on a path across the North Atlantic on September 28, 1974. The radar imagery was compared with ship reports and photographs taken during the part of the flight when no clouds were present. The wave images were related to the presence of two major storm areas in the North Atlantic just before flight time. (Author)

A76-34579 Optical properties of sea water in the infrared. L. W. Pinkley and D. Williams (Kansas State University of Agriculture and Applied Science, Manhattan, Kan.). *Optical Society of America, Journal*, vol. 66, June 1976, p. 554-558. 12 refs. Navv-supported research.

A76-35002 # Utilization of remote sensing techniques for U.S. Coast Guard missions. G. F. Woolever, L. A. Kidd (U.S. Coast Guard, Washington, D.C.), J. P. Welsh, J. A. McIntosh, and L. D. Farmer (U.S. Coast Guard, Research and Development Center, Groton, Conn.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 3-16. 8 refs.

The U.S. Coast Guard is implementing a variety of remote sensing techniques in the performance of several missions, such as for pollution surveillance, ice classification, iceberg detection and classification, vessel traffic system development, and search and rescue. Recent activities are briefly described, including examples of imagery and forecasts for future applications. (Author)

A76-35012 # Automated measurement of sea surface temperature from a geostationary environmental satellite. J. D. Tarpley and B. A. Raymond (NOAA, National Environmental Satellite Service, Suitland, Md.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 139-148. 5 refs.

An automatic technique has been developed to measure sea surface temperature using 10 micron infrared data from a geostationary operational environmental satellite. Temperature derivatives are used to discriminate between cloudy and cloud free areas. Sea surface temperatures are retrieved at a resolution of 25 km and checked against a first guess field that is maintained and updated daily. (Author)

A76-35058 # Techniques for studying sea ice drift and deformation at sites far from land using Landsat imagery. W. D. Hibler, III, W. B. Tucker, and W. F. Weeks (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, N.H.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 595-609. 12 refs. NSF-Navy-supported research.

A semi-automatic procedure is proposed for rapid and accurate transferral of ice coordinates from one Landsat image to another and for least-squares strain rate and vorticity estimation of the ice deformation with allowance for the nonparallel nature of the longitude lines and the finite curvature of the latitude lines. Particular attention is given to the examination of errors in both techniques. Examples of drift and deformation rates far from land are treated. It is shown that when analyzed with appropriate techniques, Landsat imagery is well suited for estimating sea ice drift rates at locations far from land. The errors in the transferral process are dominated by the deviation of the actual image centers from their stated centers. The typical magnitude of errors in strain rates suggest that two-day averages of strain rates should be used when estimating deformation rates from Landsat images. S.D.

A76-35059 # Spatial variability of ice thickness distribution as determined from Landsat-A. R. T. Hall (Washington, University, Seattle, Wash.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 611-619. NSF Grant No. GV-616644.

Landsat images of the Arctic pack ice have been used to measure a point on the ice thickness distribution, $G(h \text{ sub } 1)$, and examine its variability on scales considered by the AIDJEX model. The variation of $G(h \text{ sub } 1)$ as a function of sample size and distance is shown for three Landsat strips located in the Beaufort Sea for March and April 1973. In all cases there were spatial variations of $G(h \text{ sub } 1)$ on a scale of 800 km, with shorter scale variations superimposed. Although the amplitude of the shorter scale variations sometimes equals the amplitude of the larger trends the preliminary conclusion is that the measurements support using a 100 km continuum element to characterize the ice thickness distribution. (Author)

A76-35060 # Evaluation of NOAA-2 VHRR imagery for Arctic sea ice studies. M. Ostheider (München, Universität, Munich, West Germany). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 621-631. 6 refs.

Imagery taken in 1973 from NOAA-2 VHRR-radiometers have been evaluated for monitoring Arctic sea ice. Considerations were devoted to analyzing the VHRR images according to three aspects: geometry, grey tone, and time. (Author)

A76-35061 # Passive radiowave sensing of the thickness and other characteristics of sea ice. M. Tiuri, A. Laaperi, and K. Jokela (Helsinki University of Technology, Otaniemi, Finland). In: International Symposium on Remote Sensing of Environment, 10th, Ann

Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 633-636. Research supported by the Finnish-Swedish Winter Navigation Board.

During the spring of 1975 an extensive experiment to determine the characteristics of sea ice in the Baltic Sea by passive and active remote sensing methods was performed in cooperation with Finnish, Swedish and Dutch research groups. In this report the preliminary results of UHF and microwave radiometer measurements are described. The results indicate that 600 MHz and 5 GHz radiometers can be used to determine the ice thickness in the case of relative low salinity ice. Some information is also obtained about ice ridges.

(Author)

A76-35064 # Detection and measurement of the oceanic thermal front east of Korea with the Defense Meteorological Satellite System. O. K. Huh (U.S. Naval Oceanographic Office, Washington, D.C.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 653-659. 6 refs. Navy-sponsored research.

The scanning sensors of the Defense Meteorological Satellite System have provided excellent thermal infrared (8-13 micrometer) and visual range (0.4-1.1 micrometer) imagery of the oceanic regions near the Korean Peninsula. These data were acquired by direct readout from the two polar orbiting satellites which passed over the region near dawn, noon, early evening and midnight, local sun time. Sea surface temperature gradient features including oceanic fronts, eddies, frontal waves, convergences and divergences are clearly depicted on the electro-optically contoured film display at 1.6 K contour intervals. This near real-time thermal infrared data (at 3.7 km spatial resolution) provided relative temperatures, some 2-10 K colder than the actual surface measurements. Thermal gradients were faithfully reproduced, however, and could be estimated from the imagery to less than 1 K. The technical effectiveness of combining real-time high quality, high repetition rate satellite data with ship or aircraft operations has again been demonstrated as measurement traverses were deployed based on satellite data. (Author)

A76-35065 * # A biological and physical oceanographic remote sensing study aboard the Calypso. J. C. Harlan, J. M. Hill, H. A. El-Reheim (Texas A & M University, College Station, Tex.), and C. Bohn (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 661-670. 14 refs. Contract No. NAS5-20877.

The paper discusses an oceanographic remote sensing program conducted aboard the R/V Calypso in the Gulf of Mexico and the Caribbean Sea to provide information for correlating ocean measurements with remotely sensed observations. Remote sensors on satellites and aircraft are used as operations and experiment planning tools as well as for scientific data acquisition. Emphasis is on providing surface-truth measurements for OCS flights and on investigating the area of the Gulf affected by the outflow of the Mississippi River. The discussion covers the shipboard instrumentation, ocean color scanner data acquisition and results, NOAA/VHRR data analysis approach, and Landsat and APT/ATS as planning tools. The research effort has demonstrated the feasibility of using satellite data as a supportive method to aid an oceanographic research vessel on a near real-time basis. S.D.

A76-35117 # Remote sensing as it applies to the International Ice Patrol. A. D. Super and S. R. Osmer (U.S. Coast Guard, Governors Island, N.Y.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1231-1234. 7 refs.

Poor success rates in detecting icebergs by surface radar lead to a continued need for effective monitoring of shipping corridors by the International Ice Patrol. Several remote sensing techniques have been investigated as possible means of improving the speed and accuracy of iceberg detection and tracking. A precision radiation thermometer is routinely used in airborne reconnaissance missions to map sea surface temperature for use in iceberg melt determinations and in detecting current patterns. ERTS-A imagery from Return Beam Vidicon bands in the 0.6 to 1.1 micrometers band was found to be minimally applicable to iceberg detection due to frequent fog cover, time delay in user receipt of data, insufficiently fine resolution, and insufficiently frequent coverage. A high degree of success in iceberg detection has been obtained using side-looking airborne radar data. Target discrimination is accomplished by analysis of basic clues, including size, shape, shadow, texture pattern, edge, wake, and tone. C.K.D.

A76-35132 # Current status and quality of global operational sea surface temperatures from satellite infrared data. R. L. Brower, W. G. Pichel, C. C. Walton, and T. L. Signore (NOAA, National Environmental Satellite Service, Suitland, Md.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1405-1414. 8 refs.

An observatory which provides daily global surveillance of the ocean surface temperature structure has been developed by the National Environmental Satellite Service. Surface temperature values are derived from Scanning Radiometer infrared data from NOAA satellites. The GOSSTCOMP (global operational sea surface temperature computation) computer technique is used to obtain these temperature values. Surface temperature retrievals are derived by statistical analysis, and quality control techniques are applied to measurements within about 100 km square areas. Retrieval temperatures are corrected for the effects of atmospheric attenuation by using time coincident measurements derived from a Vertical Temperature Profile Radiometer. A daily set of 5000 to 7000 observations of surface temperature over the oceans of both hemispheres is obtained from the model. B.J.

A76-35625 Experimental results of the remote sensing of sea-surface salinity at 21-cm wavelength. G. C. Thomann (Wichita State University, Wichita, Kan.). *IEEE Transactions on Geoscience Electronics*, vol. GE-14, July 1976, p. 198-214. 12 refs.

The complex dielectric constant of sea water is a function of salinity at 21-cm wavelength, and sea-water salinity can be determined by measuring radiometric temperature at 21 cm and thermodynamic temperature. Three aircraft and two helicopter experiments using two different 21-cm radiometers were conducted under different salinity and temperature conditions. Ground-truth measurements were used to calibrate the data in each experiment. RMS deviations of between 2 and 3% were found between remote and ground-truth boat measurements. Part of this deviation is attributed to position mislocation between the aircraft and boats. Accuracies of 1 to 2% are possible with a single surface calibration point necessary only every two hours if the following conditions are met - water temperatures about 20 C, salinities above 10‰, level aircraft flight, and extreme care near land masses. (Author)

A76-35709 Observation of wind-induced sea surface feature off Pulu Bawean, Java, from Landsat-1. B. H. Needham (General Electric Co., Space Div., Beltsville, Md.). *American Meteorological Society, Bulletin*, vol. 57, Apr. 1976, p. 444-448.

A76-36209 # The relation between the thermal radio-frequency radiation of the sea surface and ice conditions according to data from Kosmos-384 (O svyazi teplovogo radioizlucheniia

poverkhnosti okeana s ledovymi usloviiami po dannym ISZ 'Kosmos-384'). K. P. Vasil'ev and D. T. Matveev. In: Sea hydrological forecasts and information (Morskii gidrologicheskie prognozy i informatsii). Leningrad, Gidrometeoizdat (Gidrometeorologicheskii Nauchno-Issledovatel'skii Tsentr, Trudy, No. 119), 1975, p. 28-39. 17 refs. In Russian.

The radiation characteristics of sea ice, and the effect of snow cover on these characteristics, are discussed. Radiometric data on the sea surface in the Antarctic region, taken by Kosmos-384, are analyzed in conjunction with observations of the ice conditions in the area. It is shown that reliable information on ice conditions in polar regions can be obtained under virtually all weather conditions from satellite measurements of brightness temperature. Good agreement between the ice conditions determined from Kosmos-384 radiometric data and those revealed by television photographs taken by Meteor-10 was found in areas with no cloud cover. C.K.D.

A76-36461 * # Satellite observations of snow and ice with an imaging passive microwave spectrometer. A. D. Fisher, B. L. Ledsham, P. W. Rosenkranz, and D. H. Staelin (MIT, Cambridge, Mass.). *COSPAR, Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper*. 15 p. 8 refs. Contract No. NAS5-21980.

The scanning microwave spectrometer (SCAMS) on the Nimbus-6 satellite continuously maps the terrestrial surface with a resolution of about 150 km at 22.235 and 31.400 GHz. SCAMS observes at six angles besides nadir, yielding brightness temperatures which are a function of the distribution and character of various types of snow and ice, including microstructure and subsurface profiles in refractive index, loss (moisture or salinity), and temperature. Spectral signatures exhibiting interesting topographical structure have been observed. To aid in the interpretation of these data, a model was developed to describe the propagation of microwave intensity in a scattering medium characterized by three-dimensional random fluctuations of refractive index in addition to nonrandom variations in permittivity, temperature, and loss. The model combines Maxwell's equations in the Born approximation with radiative-transfer theory; this approach yields the variation of intensity with polarization, direction, and position. (Author)

A76-36470 * Arctic odyssey - Five years of data buoys in AIDJEX. P. Martin and C. R. Gillespie. *COSPAR, Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper*. 12 p. 10 refs. Research supported by the U.S. Bureau of Land Management, U.S. Navy, NSF, NOAA, and NASA.

The Arctic Ice Dynamics Joint Experiment of 1975-1976 used data buoys in conjunction with tracking satellites to study the interaction of Arctic Sea ice with the environment, and, more specifically, to define the motion of ice on the perimeter of the area of interest and to measure surface barometric pressure over the same area. Charts are presented, indicating the position of the buoy array along with a table detailing buoy characteristics. The position fix accuracy of RAMS (Random Access Measurement System) buoys is discussed together with position errors due to the along-track motion of the observing satellites. Polar satellite data collection and tracking efficiency is assessed together with satellite system flexibility concepts. B.J.

A76-36474 * # Characteristics of Antarctic sea ice as determined by satellite-borne microwave imagers. H. J. Zwally, T. T. Wilheit, P. Gloersen, and J. L. Mueller (NASA, Goddard Space Flight Center, Greenbelt, Md.). *COSPAR, Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper*. 7 p. 7 refs.

The electrically scanning microwave radiometers on Nimbus 5 (wavelengths of 1.55 cm) and Nimbus 6 (wavelengths of 0.81 cm) produce images with a resolution of about 30 km. Weekly maps of sea ice coverage are generated, showing the percent of open water in each 2.5 x 2.5 degree cell. More detailed studies of the dynamics and thermodynamics of the sea ice and its interaction with the ocean and

the atmosphere are carried out, using 3-day average pseudo-color images and maps of ice boundaries. Features of the Antarctic ice discerned from microwave images are discussed, and the important features of Antarctic currents are illustrated. V.P.

A76-36824 Physical methods for ice and snow studies (Fizicheskie metody issledovaniia l'da i snega). Edited by V. V. Bogorodskii and V. P. Gavrilov. Leningrad, Gidrometeoizdat (Arkticheskii i Antarkticheskii Nauchno-Issledovatel'skii Institut, Trudy, Volume 326), 1975. 240 p. In Russian.

The papers deal with modern electromagnetic, optical, acoustic, dynamic, static, radar and remote sensing methods developed for studying ice and snow covers of various type in arctic regions. Advanced instruments of the type used to study the dynamics of ice masses, or for airborne measurements of the microwave emission from arctic sea ice are described. Some results obtained by domestic and foreign investigators are presented. V.P.

A76-38105* # An integrated approach to the remote sensing of floating ice. W. J. Campbell (U.S. Geological Survey; Puget Sound, University, Tacoma, Wash.), R. O. Ramseier (Department of the Environment, Ottawa, Canada), W. F. Weeks (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, N.H.), and P. Gloersen (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings.

Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 39-72. 63 refs. Research supported by the Department of National Defence, Canadian Centre for Remote Sensing, and U.S. Navy.

Review article on remote sensing applications to glaciology. Ice parameters sensed include: ice cover vs open water, ice thickness, distribution and morphology of ice formations, vertical resolution of ice thickness, ice salinity (percolation and drainage of brine; flushing of ice body with fresh water), first-year ice and multiyear ice, ice growth rate and surface heat flux, divergence of ice packs, snow cover masking ice, behavior of ice shelves, icebergs, lake ice and river ice; time changes. Sensing techniques discussed include: satellite photographic surveys, thermal IR, passive and active microwave studies, microwave radiometry, microwave scatterometry, side-looking radar, and synthetic aperture radar. Remote sensing of large aquatic mammals and operational ice forecasting are also discussed.

R.D.V.

A76-38127. # Towards an operational inventory of coastal regions. T. T. Alfoldi (Canada Centre for Remote Sensing, Ottawa, Canada) and G. E. Beanlands (Environment Canada, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 323-329.

The Atlantic Region Lands Directorate and the Canada Center for Remote Sensing are cooperating in a project to incorporate digital analysis of Landsat data into a prospective coastal resources inventory of the Atlantic provinces. Detailed studies of a test site in Nova Scotia have demonstrated the utility and the limitations of this type of information. The experience gained from the Nova Scotia tests are presently being utilized in a resource mapping study on the west coast of Newfoundland. The aim of these efforts is to take this technique from the developmental into a fully operational phase in order to take advantage of the inherent speed, timeliness and cost-effectiveness of satellite remote sensing. (Author)

N76-23646* # Division of National Mapping, Canberra (Australia). **MAPPING ISLANDS, REEFS AND SHOALS IN THE OCEANS SURROUNDING AUSTRALIA Quarterly Report, 8 Feb. - 8 May 1976**

Leonard G. Turner, Principal Investigator 8 May 1976 4 p Sponsored by NASA ERTS (E76-10319; NASA-CR-147201; QR-3) Avail: NTIS HC \$3.50 CSCL 08B

The author has identified the following significant results. The geometric accuracy test produced an estimate that the distortion levels on LANDSAT imagery are such that few corrections, or possibly no corrections, would be necessary in order to have the imagery satisfy accuracy specifications. It can be expected that the geometric accuracy of the low generation imagery, being used in distortion tests, is such that the distortions would cause no difficulty during the course of map preparation.

N76-23652* # Delaware Univ., Newark. Coll. of Marine Studies.

APPLICATION OF LANDSAT-2 TO THE MANAGEMENT OF DELAWARE'S MARINE AND WETLAND RESOURCES Progress Report, Feb. - Apr. 1976

V. Klemas, Principal Investigator, D. Bartlett, W. Philpot, and G. Davis 30 Apr. 1976 15 p refs ERTS (Contract NAS5-20983)

(E76-10325; NASA-CR-147204) Avail: NTIS HC \$3.50 CSCL 05A.

The author has identified the following significant results. Imagery from LANDSAT 1 and 2 was analyzed to determine the location, type, and extent of fronts and boundaries in Delaware Bay as a function of tidal conditions. This information is being used to set up a subroutine for an oil slick movement prediction model.

N76-23817* # Kanner (Leo) Associates, Redwood City, Calif. **COMPARISON OF RESULTS OF THE MEASUREMENTS OF THE OCEAN SURFACE TEMPERATURE MADE BY A SOVIET SCIENTIFIC RESEARCH SHIP AND AN AMERICAN ARTIFICIAL EARTH SATELLITE**

E. I. Karabasheva, V. D. Pozbrynin, V. E. Sklyarov, E. P. McLean, and S. J. Roman Washington NASA May 1976 38 p refs Transl. into ENGLISH of "Sravneniye rezultatov izmereniy temperatura poverkhnosti okeana, vypolnennykh sovetskimi nauchno-issledovatel'skimi sudnom i Amerikanskim iskusstvennym sputnikom zemli" Sov. Acad. of Sci. and the Natl. Environ. Satellite Serv., 1975 38 p (Contract NASw-2790)

(NASA-TT-F-17025) Avail: NTIS HC \$4.00 CSCL 08J

The results of a comparison of North Atlantic ocean surface temperature measurements made from the Soviet research ship Akademik Kurchatov and from the American NOAA-2 environmental research satellite are presented. Ship measurements were made with the aid of thermistor, satellite measurements with the aid of radiometers (at both visible and thermal wavelengths). Ship data are organized in the form of tables and histograms, satellite data in the form of grid-type temperature maps and infra-red photographs of the region of interest. Difficulties in comparing the data from both ship and satellite sources were partially resolved through the use of statistical comparison methods. Results indicate a high correlation between ship and satellite data, and that the combined utilization of research ships and satellites will increase the effectiveness of ocean-surface temperature studies. Author

N76-24758# Bochum Observatory (West Germany). Inst. fuer Weltraumforschung.

REMOTE SENSING OF SEA CURRENTS, THEIR AREAL DISTRIBUTION AS WELL AS THEIR ECOLOGICAL IMPORTANCE FOR THE ITALIAN ADRIATIC COAST, BASED UPON INFRARED SATELLITE DATA (NOAA-VHRR)

Heinz Kaminski 1975 19 p refs In GERMAN; ENGLISH summary Presented at the Symp. of the Foederation Europaeischer Gewaesserschutz, Venice, 22-24 Oct. 1975

Avail: NTIS HC \$3.50

A zone with a distinct temperature gradient in the area of the Italian Adriatic coast was found from the data of the environmental earth research satellites NOAA 2, 3 and 4. This coastal zone obviously depends on the submarine topography, difference in density of the water masses, constant wind streams, influence of the tides, and inflows from the Alps and the Apennines. The zone can be monitored permanently the whole year long and it shows a distinct maximum in the winter half-year. Therefore the mixing with the free Adriatic water is obviously

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very much limited, so that load factors resulting from industrial sites and urbanizations are to be taken into consideration concerning their quantity for this small constant transport zone in the coastal area in immediate front of the Italian Adriatic. The results of environmental earth research satellites make it possible to carry out large area plannings and large area supervisions. The present result is part of a voluminous study describing the supervision of the European waters and the atmosphere. The overlapping study is in the hands of the European Council. Author (ESA)

N76-25614* Norsk Polarinstittutt, Oslo.
SEA ICE STUDIES IN THE SPITSBERGEN-GREENLAND AREA Quarterly Progress Report
 Torgny E. Vinje, Principal Investigator May 1976 2 p Sponsored by NASA and Royal Norwegian Council for Sci. and Industrial Res. ERTS
 (E76-10367; NASA-CR-147959; QPR-3) Avail: NTIS HC \$3.50 CSCL 08L

N76-25644* Environmental Research Inst. of Michigan, Ann Arbor.
BASIC INVESTIGATIONS FOR REMOTE SENSING OF COASTAL AREAS Quarterly Report, 15 Jul. - 15 Oct. 1975
 R. A. Shuchman, C. T. Wozernak, D. R. Lyzenga, and F. J. Thomson 15 Oct. 1975 34 p refs
 (Contract N00014-74-C-0273; NR Proj. 389-166)
 (AD-A019959; ERIM-108900-4-L) Avail: NTIS CSCL 08/6
 This report is divided into three sections. The first section deals with progress to date in using processing techniques to extract coastal bottom information from passive multispectral scanner (MSS) data. A summary is presented on development of a reflectance model used to obtain information on coastal bottom compositions. The second section deals with the progress in the beach environment task. Preliminary results are reported on development of an algorithm to determine the percentage water by volume. Determination of mineral composition is also discussed. The final section deals with a radar study on the problem of rocky beach recognition. Various existing theories for equating radar backscattering to terrain roughness are explored. GRA

N76-25748* Stanford Research Inst., Menlo Park, Calif.
MEASUREMENT OF SEA SCATTER AND BUOY TRACKS AT LONG RANGES BY HIGH-RESOLUTION OTH-B RADAR Final Report, 1 Dec. 1973 - 31 Dec. 1975
 Joseph W. Maresca, Jr. and James R. Barnum Dec. 1975 68 p refs
 (Contract N00014-74-C-0138)
 (AD-A020128) Avail: NTIS CSCL 08/3

This is the final report on a two-year contract entitled 'Measurement of Sea Scatter and Buoy Tracks at Long Ranges by High-Resolution OTH-B Radar.' The Wide Aperture Research Facility (WARF), a high-resolution skywave high-frequency (HF) radar located in central California, was used to obtain remote measurements of the ocean wave spectrum, overwater wind velocity, and ocean currents in the North Pacific Ocean. The ocean currents were determined by tracking drogued and undrogued drifting buoys carrying a low-power HF repeater. Three types of sea backscatter Doppler spectra were recorded to determine the ocean wave spectrum and the wind velocity: (1) Backscatter from wide areas of the ocean to develop techniques for mapping wind fields, (2) Backscatter from limited areas near research vessels, Navy ships, and ships of opportunity to correlate the observed and radar-measured wind field; (3) Long-term coherent samples of backscatter for high-resolution off-line processing to derive the ocean wave spectrum. GRA

N76-26751* Naval Postgraduate School, Monterey, Calif.
MESOSCALE COMPONENTS OF THE GEOSTROPHIC FLOW AND ITS TEMPORAL AND SPATIAL VARIABILITY IN THE CALIFORNIA CURRENT OFF MONTEREY BAY IN 1973-1974 M.S. Thesis

Richard Earl Greer Sep. 1975 180 p refs
 (AD-A019284) Avail: NTIS CSCL 08/3

The mesoscale components of the geostrophic flow and its temporal and spatial variability are discussed for the oceanic region west of the continental shelf off Monterey Bay. The results were obtained from spatially dense observations on thirteen cruises between Aug. 73 and Aug. 74. Patterns of current flow indicated by drogues and geostrophy tend to confirm an analysis of the structure which has alternating elements of poleward and equatorward flow. Surface current flow patterns are similar to those found at depths to 375 m. The bottom topography influences the direction of flow inside the 1,000 fathom curve. Seasonal variations of the geostrophic flow and salt transport were congruent with Skogsberg's (1936) annual cycle composed of three distinct oceanographic seasons. The flow and structure in the area are complex with flow elements less than 10 km in width. The data suggest that observations on a sampling grid length less than 10 km transverse to the current flow, and extensive independent current measurements are required to describe adequately the small-scale features of the flow, structure and its time variations. GRA

N76-26610 Florida Univ., Gainesville.
A STUDY AND EVALUATION OF SALTWATER INTRUSION IN THE FLORIDAN AQUIFER BY MEANS OF A HELE-SHAW MODEL Ph.D. Thesis
 Andrew Joseph Evans, Jr. 1975 228 p
 Avail: Univ. Microfilms Order No. 76-12073

A Hele-Shaw model was built for the coastline zone of the middle gulf area of Florida, and all pertinent geological and hydrological features of the area were included. Steady state characteristics of the aquifer system were considered. In particular, the long-term effects due to pumping and artificial recharge were examined. Dissert. Abstr.

N76-26617* Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
LANDSAT APPLICATION OF REMOTE SENSING TO SHORELINE-FORM ANALYSIS Quarterly Report, 2 Mar. - 2 Jun. 1976
 Robert Dolan, Bruce P. Hayden, and Jeffrey Heywood, Principal Investigators 18 Jun. 1976 31 p ref. ERTS
 (Contract NAS5-20999)
 (E76-10386; NASA-CR-148166) Avail: NTIS HC \$4.00 CSCL 08C

The author has identified the following significant results. Data for Assateague Island and Ocracoke Island show significantly high correlations between coastal orientation and erosion. However, South Hatteras has low correlations, and North Hatteras has low negative correlations. Because all four areas are essentially in the same mid-Atlantic climatic regime, process/response relationships should be similar. Correlations for the four areas may differ considerably because of inadequate assumptions; the key is the mean orientation of the specific coastline being studied. There appears to be an orientation window surrounding due northeast (135 deg north of south) in which this hypothesis holds.

N76-26624* Army Engineer District, San Francisco, Calif.
CALIFORNIA COAST NEARSHORE PROCESSES STUDY USING ERTS-B DATA Progress Report, 1 Mar. - 31 May 1976
 Douglas M. Pirie and David D. Steller, Principal Investigators (ESCA-Tech Corp., Long Beach, Calif.) 25 Jun. 1976 3 p ERTS
 (NASA Order S-54062-A)
 (E76-10396; NASA-CR-148183) Avail: NTIS HC \$3.50 CSCL 05B

N76-26647* National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.

STATUS OF COASTAL ZONE MANAGEMENT TECHNIQUES

E. Lee Tilton, III *In its* NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 173-175

CSCL 08C

Remote panchromatic imagery was applied to develop a coastal zone management atlas that provides for land cover or vegetation surveys as well as land use stereographic mapping for regional planning purposes. G.G.

N76-26650* Corps of Engineers, San Francisco, Calif.

CALIFORNIA NEARSHORE SURFACE CURRENTS

Douglas M. Pirie, Michael J. Murphy, and J. Robert Edmisten *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 195-216 refs

CSCL 08C

During the oceanic period from July to November, the southward flowing California current dominates the nearshore current patterns. Commencing about the middle of November and extending to mid-February, the Davidson current, a northward moving countercurrent, is the dominant inshore transporter of water and suspensates. The phenomenon of upwelling is prevalent during the period from the middle of February to the end of July. Thus, every year along the coast of California, there are three successive current seasons: the oceanic, the Davidson, and the upwelling. This paper is a discussion of the nature of these nearshore currents. In addition, the capabilities of various remote sensing platforms and systems for providing methods of monitoring the coastal processes associated with the current seasons of California are demonstrated herein. Author

N76-26652* Geological Survey of Alabama, University.

REMOTE MEASUREMENT OF SHORELINE CHANGES IN COASTAL ALABAMA

C. Daniel Sapp *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 224-231 refs

CSCL 08C

It is shown that remotely sensed data, whether in digital or imagery form, provide objective, systematic measurements of coastal zone characteristics when compared with traditional measurement techniques. An example is given for Alabama shoreline parameters using LANDSAT 1 composite mapping. G.G.

N76-26653* Florida Coastal Coordinating Council, Tallahassee.

REMOTE SENSING APPLICATIONS AS UTILIZED IN FLORIDA'S COASTAL ZONE MANAGEMENT PROGRAM

David R. Worley *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 232-241

CSCL 08C

Land use maps were developed from photomaps obtained by remote sensing in order to develop a comprehensive state plan for the protection, development, and zoning of coastal regions. Only photographic remote sensors have been used in support of the coastal council's planning/management methodology. Standard photointerpretation and cartographic application procedures for map compilation were used in preparing base maps. Author

N76-26655* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COAST GUARD/NOAA/NASA GREAT LAKES PROJECT ICEWARN

T. D. Brennan (Coast Guard 9th District) and R. T. Gedney *In its* NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 261-270

CSCL 08L

The operational feasibility of using remote sensing to provide all weather ice formation for Great Lakes winter navigation is explored. A combination airborne pulsed radar system to measure actual ice thickness, a satellite data link system, and a hand drawn interpretive ice chart proved valuable for extending winter navigation through the icepack. G.G.

N76-26672# Florida State Univ., Tallahassee. Dept. of Urban and Regional Planning.

FLORIDA COASTAL POLICY STUDY: THE IMPACT OF OFFSHORE OIL DEVELOPMENT Final Report

Allen L. Pearman and John W. Stafford (Univ. of South Fla.) Jun. 1976 284 p refs

Avail: NTIS HC \$9.25

The impacts of possible offshore oil and gas discoveries upon the coastal areas of Florida are examined. Offshore oil and gas developments are studied from a number of perspectives: economic, environmental, legal, and social. A set of policy alternatives are identified which can be implemented to guide and regulate onshore developments so as to minimize the adverse impacts upon the areas most directly affected. The analysis of onshore impacts is based, in part, upon a review of similar developments in other coastal areas. The development of an information base which can be applied to potential developments in Florida is viewed as an essential element of this study. Author

N76-26673*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN ESTIMATE OF THE INFLUENCE OF SEDIMENT CONCENTRATION AND TYPE ON REMOTE SENSING PENETRATION DEPTH FOR VARIOUS COASTAL WATERS

Charles H. Whitlock Mar. 1976 18 p refs (NASA-TM-X-73906) Avail: NTIS HC \$3.50 CSCL 08J

Under the assumptions of collimated light, a homogenous water column, zero molecular scattering, and constant ratio of volume scattering function to scattering coefficient, estimates of the remote sensing depth parameter, Z90, are made for various coastal waters at 540 nm. Calculations indicate that sediment concentration and type have a strong influence on remote sensing depth when concentrations are below 5 mg/theta. Above 5 mg/theta, the absorption coefficient of the sediments becomes large in comparison to that of water, causing Z90 values to be less than 2 m with only small differences between various sediment types. Author

N76-26769# Naval Weather Service Detachment, Asheville, N.C.

A SYNOPTIC COMPARISON OF WIND AND WAVE REPORTS FROM OCEAN WEATHER STATION (OWS) HOTEL AND SHIPS-IN-PASSAGE M.S. Thesis

James W. Ownbey, Jr. Nov. 1975 103 p refs

(AD-A019005) Avail: NTIS CSCL 04/2

Wind speed and wave height reports from Ocean Weather Station Hotel and Ships-in-Passage through a specified area are compared synoptically to investigate possible bias in Tape Data Family-11 (a surface marine file available from the National Climatic Center). GRA

N76-27620*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE APPLICATION OF SATELLITE DATA IN THE DETERMINATION OF OCEAN TEMPERATURES AND CLOUD CHARACTERISTICS AND STATISTICS. Final Report

Robert J. Curran, Vincent V. Salomonson, and William Shenk, Principal Investigators [1975] 124 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP (E76-10382; NASA-TM-X-72599) Avail: NTIS HC \$5.50 CSCL 04B

The author has identified the following significant results. The major shortcoming of the data was the loss of the infrared radiances from the S191 spectrometer. The cloud thermodynamic

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phase determination procedure was derived and tested with the data collected by the S192 multispectral scanner. Results of the test indicate a large fraction of the data could be classified thermodynamically. An added bonus was the inclusion of snow in the classification approach. The conclusion to be drawn from this portion of the effort is that in most cases considered ice clouds, liquid water droplet clouds, and snow fields can be spectroscopically separated to a high degree of accuracy.

**N76-27631*# Geological Survey, San Juan (Puerto Rico).
THE UTILITY OF SKYLAB PHOTO-INTERPRETED EARTH
RESOURCES DATA IN STUDIES OF MARINE GEOLOGY
AND COASTAL PROCESSES IN PUERTO RICO AND THE
VIRGIN ISLANDS Final Report, 31 May 1973 - 15 Oct.
1975**

James V. A. Trumbull, Principal Investigator 15 Oct. 1975
133 p. refs. Original contains color imagery. Original photography
may be purchased from the EROS Data Center, 10th and Dakota
Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4658-B)
(E76-10414; NASA-CR-147437) Avail: NTIS HC \$6.00 CSCL
08J

The author has identified the following significant results. Three Skylab earth resources passes over Puerto Rico and St. Croix on 6 June and 30 November 1973 and 18 January 1974 resulted in color photography and multispectral photography and scanner imagery. Bathymetric and turbid water features are differentiable by use of the multispectral data. Photography allows mapping of coral reefs, offshore sand deposits, areas of coastal erosion, and patterns of sediment transport. Bottom sediment types could not be differentiated. Patterns of bottom dwelling biologic communities are well portrayed, but are difficult to differentiate from bathymetric detail. Effluent discharges and oil slicks are readily detected and are differentiated from other phenomena by the persistence of their images into the longer wavelength multispectral bands.

**N76-27763# Development and Resources Transportation Co.,
Silver Spring, Md.**

**POTENTIAL USE OF SATELLITE IR DATA FOR ICE
THICKNESS MAPPING Final Report**

Leonard A. LeSchack Mar. 1975 33 p. refs
(Contract NOAA-3-35384)
(PB-250490/0; NOAA-76012705) Avail: NTIS HC \$4.00 CSCL
08L

An approach to automated mapping of the thickness and movement of Arctic ice by means of statistical examination of NOAA VHRR satellite IR data is discussed. Data are examined so that it is now possible to outline the basic steps for implementing an algorithm to automate ice mapping. Five passes made by NOAA-2 and NOAA-3 satellites were used for the analysis. These passes provided radiant temperature data of the Beaufort Sea ice during January, February, March, April, and May 1974. Examination of the shapes of the temperature distribution histograms derived from the data suggested differences that could be delineated by simple statistical techniques. GRA

N76-27808*# Ocean Data Systems, Inc., Monterey, Calif.

SURFACE PROPERTIES OF OCEAN FRONTS Final Report

Paul M. Wolff and William E. Hubert 5 Apr. 1976 138 p.
refs
(Contract NAS5-22370)
(NASA-CR-144776) Avail: NTIS HC \$6.00 CSCL 08J

Background information on oceanic fronts is presented and the results of several models which were developed to study the dynamics of oceanic fronts and their effects on various surface properties are described. The details of the four numerical models used in these studies are given in separate appendices which contain all of the physical equations, program documentation and running instructions for the models. Author

HYDROLOGY AND WATER MANAGEMENT

Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.

A76-31772 **Glaciations and dense interstellar clouds.** B. Dennison (Cornell University, Ithaca, N.Y.) and V. N. Mansfield (Colgate University, Hamilton, N.Y.). *Nature*, vol. 261, May 6, 1976, p. 32-34; 13 refs. NSF-supported research.

The theory proposed by McCrea in which the ice ages are attributed to the interaction of the sun with dense interstellar clouds is examined. The lack of extensive absorption of soft X-ray background and the low column densities of molecular hydrogen derived from satellite observations of H₂ absorption lines in selected stars rule out the existence of a dense molecular cloud of large size. It is shown that no significant fraction of the hypothetical cloud could be in the form of atomic or ionized hydrogen. A cloud consisting of dust particles could not be appreciably accreted on to the sun since mutual collisions are required to destroy the systematic velocity of the cloud as it sweeps past the sun. It is calculated that replenishment of the zodiacal dust cloud after the last glaciation (10,000 years ago) would require 100,000 years. An alternative possibility is that the proposed mechanism acts as a rapid trigger for a longer lived glacial episode. C.K.D.

A76-32423 **Investigation of water resources from space.** T. Maruyasu (Tokyo University of Science, Noda, Chiba, Japan) and S. Tanaka (Tokyo University, Tokyo, Japan). In: International Symposium on Space Technology and Science, 11th, Tokyo, Japan, June 30-July 4, 1975, Proceedings. Tokyo, AGNE Publishing, Inc., 1975, p. 897-902.

ERTS imagery of the Kumano river basin in Japan is analyzed. Differences in the tone of water in different reservoirs correspond to differences in turbidity. The amount of particulate matter in a given reservoir is dependent on local vegetation and geological features. Differences in vegetation could be distinguished from the ERTS data, and served as an indicator of the presence of the weak Shimanto for stretching and bending case illustrate the merits of the above mentioned formulation. (Author)

A76-33197 * # **The use of ERTS imagery for lake classification.** F. L. Scarpace, R. E. Wade, and L. T. Fisher (Wisconsin, University, Madison, Wis.). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 259-271. Research supported by the Wisconsin Department of Natural Resources; Grant No. NGL-50-002-127.

The feasibility of using photographic representations of the ERTS imagery to classify lakes in the State of Wisconsin as to their trophic level was studied. Densitometric readings in band 5 of ERTS 70 mm imagery were taken for all the lakes in Wisconsin greater than 100 acres (approximately 1000 lakes). An algorithm has been developed from ground truth measurements to predict from satellite imagery an indicator of trophic status. (Author)

A76-33207 # **Limits of ERTS imagery as a tool for studying the break-up of the Mackenzie river, N.W.T. experiences in 1973 and 1974.** D. A. Sherstone, K. C. Arnold, and D. K. MacKay (Environment Canada, Ottawa, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 403-417.

ERTS imagery of the Mackenzie river ice thaw was studied to determine the extent to which it could replace or supplement air and ground observations of ice breakup. ERTS 'quick-look' prints were compared with 1:250,000 scale topographic maps, using a large hand magnifying lens. The progress of ice breakup was further charted, using a zoom transfer scope to plot 'quick-look' data directly onto 1:250,000 overlays. Several images were examined with a color densitometer in an attempt to enhance discrimination between land and water areas. Limitations of ERTS imagery in predicting ice breakup are identified, including incapability of distinguishing between land areas and adjacent open water and impossibility of discriminating between different ice types or moving ice and fast ice. It is concluded that ERTS 'quick-look' imagery as presently available is not a viable alternative to air and ground based ice breakup studies. S.D.

A76-34932 * **Remote measurement of water color.** W. R. McCluney (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Remote Sensing of Environment*, vol. 5, no. 1, 1976, p. 3-33. 66 refs.

This paper contains a discussion of the requirements and approaches which can be taken in the development of techniques for the analysis of remote multispectral imagery of natural bodies of water. There are two general approaches which can be used in the analysis of multispectral water color data collected by aircraft or satellite remote sensors. With the theoretical modeling approach, optically important constituents of natural waters are mathematically related to the upwelling radiance spectrum received by the remote sensor. With the empirical approach, the relationships are determined empirically by comparing remote sensing data with surface truth data. There are several levels of mathematical sophistication which can be applied to both approaches. The two approaches are discussed in some detail and it is concluded that the two approaches are closely related and should be pursued simultaneously for maximum utilization of the laboratory and field measurement data which will be needed. A set of minimum surface truth measurement parameters and techniques is suggested. (Author)

A76-34935 **Circulation observations in the Louisiana Bight using LANDSAT imagery.** L. J. Rouse and J. M. Coleman (Louisiana State University, Baton Rouge, La.). *Remote Sensing of Environment*, vol. 5, no. 1, 1976, p. 55-66. Contract No. N00014-75-C-0192. NR Project 388-002.

A method for quantifying the turbidity of offshore water masses using LANDSAT imagery is discussed and the results of a laboratory experiment correlating radiance with concentrations of suspended Mississippi River sediment are presented. The results of the experiment are used to plot suspended sediment contours on eight LANDSAT images of the Louisiana Bight. These contours are observed to depend on the speed and direction of the wind as well as the amount of fresh water discharged by the Mississippi River. The presence of a clockwise circulation in the bight is also indicated by the contours. (Author)

A76-35038 # **Remote sensing investigation on Lake Biwa.** T. Sakata (Tokai University, Hiratsuka, Kanagawa, Japan), H. Shimoda (Tokai Research and Information Center, Hiratsuka, Kanagawa, Japan), K. Tanaka, and T. Suzuki (Asia Air Survey Co., Tokyo, Japan). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 401-410.

Remote sensing technique was applied to a limnological survey. Multiband photographs of Lake Biwa in Japan were taken from a helicopter with 4 Hasselblad cameras while field observation and sampling of lake water were made from a boat. The multiband images were analyzed with an analog processor TIAS-I. Plumes of river discharges and several kinds of coastal plants were enhanced with this analysis. (Author)

A76-35039 * # An investigation of the waters in the lower Chesapeake Bay area. D. E. Bowker, W. G. Witte (NASA, Langley Research Center, Hampton, Va.), P. Fleischer, T. A. Gosink, W. J. Hanna, and J. C. Ludwick (Old Dominion University, Norfolk, Va.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 411-420.

Since October of 1972 the Langley Research Center and the Old Dominion University have been engaged in a cooperative effort to investigate the waters of the lower Chesapeake Bay area. During the first year an intensive effort was made to collect water data at the time of Landsat-1 overpasses. Bands 5 and 6 of the multispectral scanner (MSS) were shown to be useful for monitoring total particles, although a daily calibration was required. Band 5 had a high correlation with sediment and under some conditions an internal correction for atmospheric interference was possible. The relation of sediment to particles was established by using the MSS radiance values, since the two parameters were not monitored at the same stations. A contouring program was developed to display the sediment variation in the lower Bay at the time of the Jan. 26, 1973, overpass. Attenuation coefficients monitored continuously by ship along three baselines were cross-correlated with radiance values on three days. Evidence for tidal effects was obtained by showing that correlations improved when ship data collected during the nearest 'tidal time' instead of physical time were used. (Author)

A76-35041 # Application of Landsat to the surveillance and control of eutrophication in Saginaw Bay. R. H. Rogers, N. J. Shah, J. B. McKeon, C. Wilson, L. Reed (Bendix Corp., Aerospace Systems Div., Ann Arbor, Mich.), V. E. Smith (Cranbrook Institute of Science, Bloomfield Hills, Mich.), and N. A. Thomas (U.S. Environmental Protection Agency, Grosse Ile, Mich.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 437-446. 7 refs.

Computer techniques developed for mapping water quality parameters from Landsat data are demonstrated, using ground truth data collected in an ongoing survey of water quality in Saginaw Bay (Lake Huron), Michigan sponsored by the U.S. Environmental Protection Agency. Chemical and biological parameters were collected at 27 bay stations in concert with Landsat overflights. Application of stepwise linear regression to twelve of these parameters and corresponding Landsat measurements resulted in relationships that can be applied to map any one of the twelve water quality parameters over the entire bay. The regression correlation coefficients varied from 0.99 for total phosphorus to 0.72 for chlorophyll a corrected. Five of the water quality parameters are best correlated with Landsat Band 6 alone. One parameter, temperature, relates to Band 5 alone and only two bands are justified for mapping the remaining six parameters. (Author)

A76-35043 * # Skylab analysis of San Francisco Bay. D. D. Steller (ESCA-Tech Corp., Long Beach, Calif.) and D. M. Pirie (U.S. Army, San Francisco, Calif.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 461-470. 13 refs. NASA Order A-85918-A.

The distribution and volume of sediment present in suspension during the Skylab 4 overpass for San Pablo Bay and the Carquinez Strait is studied along with the movement and eventual distribution of both natural and dredged sediment in San Francisco Bay. The most useful Skylab sensor film is found to be the S-190B color photography. Changes in temperature, dissolved oxygen, pH, salinity, and pollutants information simultaneously collected are correlated with the spectral differences observed in the various Skylab data. The techniques outlined should be applicable for coastal and estuarine

process studies in other areas. A suspensate concentration of about 2 mg/liter is quite sufficient to tag a surface current system, and the surface structure of currents with over 250 mg/liter can be imaged by using progressively longer wavelength filters. S.D.

A76-35119 * # Measurements of snow cover over land with the Nimbus-5 microwave spectrometer. K. F. Kunzi (Bern, Universität, Berne, Switzerland) and D. H. Staelin (MIT, Cambridge, Mass.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1245-1253. 6 refs. Contract No. NAS5-21980.

A76-35121 # Hydrologic studies in Alaska using NOAA VHRR imagery. R. D. Seifert (Alaska, University, Fairbanks, Alaska), D. L. Kane, and R. F. Carlson. In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. (A76-35001 16-43) Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1263-1272. 8 refs. Grant No. NOAA-5-35190.

The spring snowmelt period for both the 1974 and 1975 seasons in Alaska was studied synoptically with the aid of the NOAA series satellites. The satellites are sun-synchronous and polar-orbiting. Their orbit, at a nominal altitude of 1500 km, provides views of Alaska at 1000 and at 2000 local time. The on-board sensor used was the Very High Resolution Radiometer (VHRR) with channels for the visible and thermal infrared spectral ranges. River basin descriptions are considered and visible imagery studies are discussed. Attention is also given to additional hydrologic applications of VHRR imagery. G.R.

A76-35123 # Inland lakes water quality and watershed planning - An application of remote sensing technology. R. K. Raney, C. T. Wezernak (Michigan, Environmental Research Institute, Ann Arbor, Mich.), T. Borton (Environmental and Urban Planning Services, Inc., Ann Arbor, Mich.), T. Haga (Genesee County Metropolitan Planning Commission, Flint, Mich.), and J. Smeets (Fenton Township Board of Supervisors, Fenton, Mich.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1285-1296. 6 refs.

A76-35124 # Remote sensing techniques applied to the study of fresh water springs in coastal areas of Southern Italy. M. Guglielminetti, R. Boltri (IDROTECNICO S.p.A., Pesaro, Italy), and C. M. Marino (IDROTECNICO S.p.A., Pesaro; Milano, Università, Milan, Italy). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1297-1309. 7 refs.

A76-35125 # Quantitative evaluation of the minimum fresh water spring flow in the sea by means of thermal surveys. G. M. Lechi and M. Tincati (CNR, Istituto per la Geofisica della Litosfera, Milan, Italy). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1311-1318.

A76-35126 # Applied remote sensing of the lower Atchafalaya Basin floodway. A. J. Lewis, S. T. Kim, R. T. Wilson, J. A. Monte, and R. C. McDonald (Louisiana State University, Baton Rouge, La.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1319-1328.

A76-35127 # Applications of remote sensing for Corps of Engineers programs in New England. H. L. McKim, C. J. Merry, D. M. Anderson, L. W. Gajto (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, N.H.), and S. Cooper (U.S. Army, Corps of Engineers, Waltham, Mass.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1331-1345. 8 refs.

Several remote sensing studies related to environmental and hydrologic problems have been implemented. The studies had the objective to determine the resolution, availability, type, and scale of the photographic products required for the various Corps of Engineers programs. The studies discussed are related to the Landsat program, the earth resources experiment package-Skylab, the Dickey-Lincoln school project in Maine, and an investigation of inundation damage to vegetation at selected New England flood control reservoirs. G.R.

A76-35131 * # Operational Applications of Satellite Snowcover Observations Project. A. Rango (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1367-1376.

The ongoing Operational Applications of Satellite Snowcover Observations (OASSO) Project of NASA's Applications Systems Verification Test (ASVT) Program is discussed. The general objectives, organization, and study-area activities of the OASSO program are outlined. It is noted that this part of the ASVT Program is designed to evaluate under operational conditions the overall utility of satellite snowcover observations for stream flow forecasts and will be carried out in four regions centered in Arizona, California, Colorado, and Oregon. F.G.M.

A76-35136 # Shorelands management using remote sensing techniques. J. P. Dooley, F. A. Clinton, and M. R. Jannereth (Michigan State, Dept. of Natural Resources, Lansing, Mich.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1447-1450.

The Shorelands Protection and Management Act has the objective to prevent the spread of the erosion damage problem in the area of the Great Lakes Basin. The Act places, therefore, restrictions on the siting of new construction in high risk erosion areas. Remote sensing techniques have been utilized as an aid in the formulation of effective building setback requirements in high risk erosion areas of Michigan's Shorelands. The use of aerial photography in the study of bluff recession is discussed, taking into account two methods for conducting actual recession rate measurements. G.R.

A76-38123 # An evaluation of a mathematical model for water colour spectral analysis. S. C. Jain, J. R. Miller (York University, Downsview, Ontario, Canada), and W. R. McNeil (W. R. McNeil and Associates, Inc., Toronto, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 289-296. 11 refs.

A technique is evaluated that attempts to make the interpretation of spectral albedo curves obtained by passive spectroscopic measurements over water precise and reliable. A 'two-flow' radiative-transfer model has been used to predict the parameters pertinent to water quality by analyzing reflectance data obtained over different water masses. This technique employs the chlorophyll concentration, Mie scattering coefficient, and molecular scattering coefficient to obtain an optimized fit to the observed reflectance curve. By comparing these results with ground-truth data, the reliability of this

model is examined. The validity of the 'two-flow' model over a large range of chlorophyll concentration and turbidity is examined through this method. Also, the model is used to examine the dependence of the shape of the spectral albedo curve on the scattering and absorption properties of water. (Author)

A76-38126 # Experiences in snow cover mapping in the Saint John River Basin. P. L. Hansen (New Brunswick Department of the Environment, Fredericton, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 315-322.

A76-38128 # The application of Landsat-1 digital data to a study of coastal hydrography. R. P. Rukata, J. E. Bruton, J. H. Jerome, A. G. Bobba (Canada Centre for Inland Waters, Burlington, Ontario, Canada), and G. P. Harris (McMaster University, Hamilton, Ontario, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 331-348. 6 refs.

Digital apparent-radiance data from the Landsat-1 spacecraft, collected along the coastline of Nottawasaga Bay in southern Georgian Bay, have been used to study the application of such data to coastal bathymetry. These data have been compared with existing hydrographic charts for areas which have been well-defined in terms of depth contours. The result is that the Band 4 (0.5-0.6 micron) MSS data clearly delineate the bottom contours in coastal regions for which the surface turbidity is substantially less than 1 FTU. Under such conditions of lake-water turbidity, the maximum optical penetration defining the Band 4 response appears to be about 14 meters. The energy return from a relatively clear inland lake is discussed in terms of volumetric and bottom effects. Attempts are made at comparing the Landsat-1 digital data with 'in-situ' measurements of optical parameters. An iterative technique for estimating bottom reflectivity coefficients is also discussed. (Author)

N76-22629*# Texas A&M Univ., College Station. Remote Sensing Center.

SPECTRAL MEASUREMENT OF WATERSHED COEFFICIENTS IN THE SOUTHERN GREAT PLAINS. Progress Report, Dec. 1975 - Feb. 1976

Bruce J. Blanchard, Principal Investigator. Apr. 1976. 15 p. ERTS

(Contract NAS5-22534)

(E76-10311; NASA-CR-146824; RSC-3273-2) Avail: NTIS HC \$3.50 CSCL 08H

N76-22631*# California Univ., Berkeley. Space Sciences Lab.

USE OF SKYLAB IMAGERY TO ASSESS AND MONITOR CHANGE IN THE SOUTHERN CALIFORNIA ENVIRONMENT Final Report

R. N. Colwell, Leonard W. Bowden, Principal Investigators. James R. Huning, Claude W. Johnson, Charles F. Hutchinson, Anthony O. Clarke, and Robert M. Petersen. 31 Dec. 1974. 62 p. refs. Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198. EREP

(Contract NAS9-14420)

(E76-10315; NASA-CR-147561; SSL-Ser-17-Issue-5) Avail: NTIS HC \$4.50 CSCL 08F

The author has identified the following significant results. The tectonic framework of the Salton Trough may be seen more clearly than ever before when viewed on Skylab imagery. Structural sketch maps were compiled from each frame of the imagery as photomaps delineating observable lineaments, many being extended beyond their prior ground-evaluated extremities. The study of the San Bernardino Mountains has shown that even

by using high resolution Skylab imagery, surrogates must be developed in order to determine the relative age of the geomorphic surfaces which were studied. The most powerful surrogate for age determination was found to be reflectance. Reflectance was a function of age as indicated by the darkness of varnish; the older the surface the darker its signature. A test site at Ivanpah Dry Lake in eastern California was used to determine the environments that were to be isolated. Using the technique described by Tapper for density slice edge enhancement, transmittance values for four areas were extracted from the imagery using a microdensitometer. The silver masking technique of enhancement was used to maximize contrast between the designated entities and their surroundings. It was shown that Skylab imagery is exceedingly useful for assessment of ground water resources, both in terms of spatial distribution and behavior, in remote regions. Arid lands such as the south central Mojave Desert are most amenable to these techniques. The geohydrologic units within the study area are easily delineated by noting geohydrologic barriers such as drainage divides faults and lithologic contacts.

N76-22634* National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
TESTING OF A TECHNIQUE FOR REMOTELY MEASURING WATER SALINITY IN AN ESTUARINE ENVIRONMENT
 Gary C. Thomann Jan. 1975 36 p refs
 (NASA-TM-X-73049; ERL-M118) Avail: NTIS HC \$4.00 CSCL 08J

An aircraft experiment was flown on November 7, 1973 to test a technique for remote water salinity measurement. Apparent temperatures at 21 cm and 8-14 micron wavelengths were recorded on eight runs over a line along which the salinity varied from 5 to 30‰. Boat measurements were used for calibration and accuracy calculations. Overall RMS accuracy over the complete range of salinities was 3.6%. Overall RMS accuracy for salinities greater than 10‰, where the technique is more sensitive, was 2.6%. Much of this error is believed to be due to inability to exactly locate boat and aircraft positions. The standard deviation over the eight runs for salinities $>$ or $=$ 10‰ is 1.4%; this error contains a component due to mislocation of the aircraft also. It is believed that operational use of the technique is possible with accuracies of 1-2%. Author

N76-22648# Delft Hydraulics Lab. (Netherlands).
COMPUTATION OF VELOCITY PROFILES IN SCOUR HOLES
 H. N. C. Breusers Nov. 1975 10 p refs Presented at the 16th Intern. Assoc. for Hydraulic Res. Congr., Sao Paulo, Brazil, Jul. 1975
 (Publ-152) Avail: NTIS HC \$3.50

The applicability of the Reichardt free turbulent shear flow method to predict velocity profiles in scour holes was investigated. A numerical solution of the resulting equation in a boundary flow is presented. Results are compared with experimental results. It is shown that the method gives an approximate description of the velocity distribution in a scour hole. It may, however, be used to compare the effect of various initial velocity profiles and to compute the final equilibrium shape of the scour hole. If a relation is established between the bed velocity and local sediment transport it can also be used to compute the development of scour holes. ESA

N76-22649# Delft Hydraulics Lab. (Netherlands). Lab. de Voorst.
HYDRODYNAMIC TRANSPORT PHENOMENA IN ESTUARIES AND COASTAL WATERS. SCOPE OF MATHEMATICAL MODELS
 C. B. Vreugdenhil and J. Voogt (Rijkswaterstaat) Dec. 1975 21 p refs Presented at the Am. Soc. of Civil Engr. Symp. Modeling 75, San Francisco, 3-5 Sep. 1975
 (Publ-155) Avail: NTIS HC \$3.50

An analysis is given of the assumptions in different types of models. The starting-point is formed by the equations for three-dimensional turbulent flow. An estimate of the importance of various terms is given. By several averaging processes, increasingly simpler models are obtained, but the interpretation of coefficients becomes increasingly more difficult. Also the

numerical possibilities are discussed, with special emphasis on aspects of accuracy and nonlinear stability, which are considered the most important numerical problems. Attention is limited to nearly horizontal flow, although the influence of short waves on these flows is also treated. In the discussion the parallel between momentum and mass transfer (hydrodynamics and water quality) is taken into account. Author (ESA)

N76-22652# Office of Water Research and Technology, Washington, D.C. Water Resources Scientific Information Center.

A SELECTED ANNOTATED BIBLIOGRAPHY ON THE ANALYSIS OF WATER RESOURCE SYSTEMS, VOLUME 6
 Daniel P. Loucks Sep. 1975 484 p

(PB-247098/7; OWRT/WSIC-75-201-Vol-6; W76-01517)
 Avail: NTIS HC \$12.50 CSCL 13B

An annotated bibliography consisting of 301 abstracts of selected publications issued in 1973 and 1974 is presented. The bibliography to the application of systems analysis techniques or defining and evaluating alternative solutions to water resource problems. The abstracted material emphasizes the application of optimization and simulation techniques for assisting the planning and management of water resource systems. GRA

N76-22654# American Society of Civil Engineers, New York.
PROCEEDINGS OF THE CONFERENCE ON INTERDISCIPLINARY ANALYSIS OF WATER RESOURCE SYSTEMS
 J. Ernest Flack 1975 421 p refs Conf. held at Boulder, Colo., 19-22 Jun. 1973
 (Contract DI-14-31-0001-3757)
 (PB-248596/9; W76-03005; OWRT-X-126(3757)(1)) Avail: NTIS HC \$11.00 CSCL 13B

The Water Resources Systems Committee of the American Society of Civil Engineers; Technical Council on Water Resources Planning and Management saw a critical need for developing an interdisciplinary approach to water resources development. Formal papers on six interdisciplinary efforts were selected as case studies, around which discussions were built. These six papers include interdisciplinary studies on: (1) large reservoirs in Africa; (2) limnological modeling of the Great Lakes; (3) geothermal development; (4) the North Atlantic Regional Water Resources Study; (5) Corps of engineers planning experience in the St. Louis-Maine Creek; and (6) University research in the Wisconsin River and the Lower Fraser River (Brit. Columbia) water quality studies. Discussions are given after each paper. Included also is an introductory article on the interdisciplinary aspects of water resources planning and management. GRA

N76-23651* Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF EREP DATA WITHIN THE SUSQUEHANNA RIVER BASIN Final Report, 1 May 1973 - 30 Nov. 1975
 G. J. McMurtry and G. W. Petersen, Principal Investigators Jan. 1976 273 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
 (Contract NAS9-13406)
 (E76-10324; NASA-CR-147541; ORSER-SSEL-TR-2-76) Avail: NTIS HC \$9.00 CSCL 08F

The author has identified the following significant results. Photography from the S190A and S190B sensors was compared, for terrain analysis. The S190B photographs were used for terrain mapping of three test areas selected as being representative of major physiographic regions in Pennsylvania. Skylab photography was superior to both LANDSAT imagery and high altitude aircraft photography for purposes of accurate location of lineaments. Analysis of Skylab imagery has shown that long lineaments originally plotted on LANDSAT images are actually made up of shorter segments. Correlation of lineaments with ore deposits was determined following the preparation of a Pennsylvania mineral deposit map. Digital wave number analysis (spatial filtering) was attempted to determine if it can be used to enhance

certain subtle features, and in particular, to locate and verify lineaments. Various spectral bands and channels of the MSS digital data were evaluated for their value in the classification and thematic mapping.

N76-23654*# Louisiana State Univ., Baton Rouge. Div. of Engineering Research.

INTERPRETATION OF REMOTE SENSING DATA IN THE BAYOU LAFOURCHE DELTA OF SOUTH LOUISIANA
Annual Report, Feb. 1975 - May 1976

Charles A. Whitehurst, Principal Investigator May 1976 91 p refs ERTS
(Grant NGL-19-001-105)
(E76-10327; NASA-CR-147206) Avail: NTIS HC \$5.00 CSCL 08B

N76-23655*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ATCHAFALAYA RIVER BASIN STUDY. PART 5: EVALUATION OF SATELLITE REMOTE SENSING AND AUTOMATIC DATA TECHNIQUES FOR CHARACTERIZATION OF WETLANDS AND COASTAL MARSHLANDS (SKYLAB)

Robert H. Cartmill, Principal Investigator Dec. 1975 33 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(E76-10328; NASA-TM-X-73053; Rept-153) Avail: NTIS HC \$4.00 CSCL 08J

The author has identified the following significant results. The basic conclusion of this study is that the quality of Skylab scanner data is inferior in quality to LANDSAT MSS data. The noise confusion seriously affected the accuracy of classification of surface features. This precluded any meaningful evaluation of other features of the scanner such as the conical scan. Instrument noise greatly reduced the accuracy of classifications obtained by the pattern recognition programs.

N76-23656*# Atomic Energy Commission, Dacca (Bangladesh). **INVESTIGATIONS USING DATA FROM LANDSAT-2**
Quarterly Report, Jul. 1975 - Mar. 1976

Anwar Hossain, Principal Investigator Apr. 1976 6 p refs Sponsored by NASA and Bangladesh Natl. ERTS Comm. ERTS (E76-10329; NASA-CR-147210; QR-3) Avail: NTIS HC \$3.50 CSCL 05B

The author has identified the following significant results. LANDSAT imageries have given positive indication of new land formation in the Bay of Bengal. A map of the bay region showing depth of new formations south of Patherghata test site was prepared. Winter crop estimation of the Sylhet-Mymensingh districts was made. This estimate shows an agreement of about 93% with 1973 data of the Agriculture Department. A preliminary land use map of the Sylhet-Mymensingh area using LANDSAT imageries in conjunction with aerial photographs and ground survey was also prepared.

N76-23788*# Kanner (Leo) Associates, Redwood City, Calif. **PHYSICAL METHODS OF INVESTIGATION OF ICE AND SNOW**

V. V. Bogorodskiy, ed. and V. P. Gavrilov, ed. Washington NASA May 1976 241 p refs Transl. into ENGLISH of the book "Fizicheskiye Metody Issledovaniya Lda i Snega" Leningrad, Giprometeoizdat, 1975 228 p

(Contract NASw-2790)
(NASA-TT-F-17009) Avail: NTIS HC \$8.00 CSCL 08L

This collection contains material from a scientific symposium organized by the Order of Lenin Arctic and Antarctic Scientific Research Institute and the Interdepartmental Commission on the Study of the Antarctic, Earth Sciences Section, Presidium of the

Academy of Sciences U.S.S.R., held in Leningrad 1-5 October 1973. The articles presented, by both Soviet and foreign scientists, reflect the results of investigations of recent years in the following areas: (1) electromagnetic methods of investigation of ice and snow; active and passive radar methods of investigation of the ice and snow cover; (2) optical methods of investigation of the ice, snow and water; (3) dynamic and static methods of investigation of the mechanical properties of ice and snow.

Author

N76-24661*# Norsk Polarinstitutt, Oslo.

GLACIOLOGICAL AND MARINE BIOLOGICAL STUDIES AT PERIMETER OF DRONNING MAUD LAND, ANTARCTICA
Progress Report

Olav Orheim, Principal Investigator 27 May 1976 5 p Sponsored by NASA and Roy. Norwegian Council for Sci. and Industrial Res. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10341; NASA-CR-147225; QPR-3) Avail: NTIS HC \$3.50 CSCL 08A

N76-24673*# Department of Surveys and Lands, Gaborone (Botswana).

AN AID TO THE DEVELOPMENT OF BOTSWANA'S RESOURCES: SECTION ON HYDROLOGY Quarterly Report

William L. Dickson, Principal Investigator and Brian Harold Wilson May 1976 6 p Revised Sponsored by NASA ERTS
(E76-10353; NASA-CR-147245) Avail: NTIS HC \$3.50 CSCL 08H

The author has identified the following significant results. It is proved that FCC's can be used for a simple estimate of the total evapotranspiring area of the Okavango Delta, sufficiently accurate for preliminary inputs for the development of mathematical model of the surface hydrology of the delta. The color coded matrix has shown as interesting inverse correlation with an array on the same grid prepared by ecologists from air photography study, for percent liable to flood.

N76-24674*# Department of the Environment, Ottawa (Ontario). Applied Hydrology Div.

RETRANSMISSION OF HYDROMETRIC DATA IN CANADA
Quarterly Report, Jan. - Mar. 1976

R. A. Halliday, Principal Investigator and I. A. Reid Apr. 1976 11 p ERTS
(E76-10354; NASA-CR-147246) Avail: NTIS HC \$3.50 CSCL 08H

The author has identified the following significant results. The project continues to demonstrate the feasibility of transmitting hydrometric data to polar orbiting spacecraft and using these data on a quasi-operational basis. The implementation of the receive site in Alaska in December 1975 has significant impact on the Canadian experiment as the number of transmissions received from some northern and northwestern sites has increased substantially.

N76-24688# World Meteorological Organization, Geneva (Switzerland).

METEOROLOGICAL AND HYDROLOGICAL DATA REQUIRED IN PLANNING THE DEVELOPMENT OF WATER RESOURCES (PLANNING AND DESIGN LEVEL)

V. G. Andrejanov 1975 48 p refs
(WMO-419; OHR-5; ISBN-92-63-10419-0) Avail: NTIS HC \$4.00; WMO, Geneva Sw. Fr.10

The meteorology for calculating meteorological and hydrological characteristics and parameters is discussed together with methods of calculating individual elements of the hydrometeorological regime. A summary of the characteristics and parameters required in the planning of various structures and measures for diverse types of water resource use is also included. ESA

06 HYDROLOGY AND WATER MANAGEMENT

N76-24689# World Meteorological Organization, Geneva (Switzerland).

HYDROLOGICAL FORECASTING PRACTICES

A. I. Afanasiev and T. J. Nordenson, ed. 1975. 149 p refs (WMO-425; OHR-6; ISBN-92-63-10425-5) Avail: NTIS HC \$6.00

The basic principles of, and approaches to, hydrological forecasting are summarized. Specific types of hydrological forecasts are described in detail. These include: forecasting rainfall-induced floods, flood prediction in lower river reaches and snow-melt induced floods; prediction of water supply over long periods of time; forecast of low flows in rivers; and ice freeze and break-up prediction. An evaluation of the effectiveness of forecasting methods and of the degree of success of operational hydrological forecasts is also included. ESA

N76-24690# World Meteorological Organization, Geneva (Switzerland).

INTERCOMPARISON OF CONCEPTUAL MODELS USED IN OPERATIONAL HYDROLOGICAL FORECASTING Final Report

1975 197 p refs

(WMO-429; OHR-7; ISBN-92-63-10429-8) Avail: NTIS HC \$7.50

The aim and implementation of the intercomparison project are outlined and a generalized description of models submitted is given. The standard data sets used in the project and spin limitations as well as the data requirements of various models are discussed. The graphical and numerical verification results of the simulations produced by the tested models are reviewed together with evaluations of the limits of application of the models and the river basins on which they were tested. ESA

N76-24694# Fort Valley State Coll., Ga. Div. of Agriculture. **WATER RESOURCES: UTILIZATION AND CONSERVATION IN THE ENVIRONMENT Final Report, Feb. - Aug. 1975**

M. C. Blount Aug. 1975 479 p refs

(Grant EPA-R-803107)

(PB-247612/5; EPA-600/9-75-006) Avail: NTIS CSCL 13B

Proceedings are given of the Southeast Region Water Resources Symposium held at Fort Valley State College on February 28 to March 1, 1974. The symposium covered comprehensively agriculture's involvement with water: conservation and management of supplies, hazards to water quality and some means of controlling them, and urban erosion control where rural erosion control practices are finding application. GRA

N76-25606*# Corps of Engineers, Waltham, Mass.

THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Progress Report

Saul Cooper, Principal Investigator 1 Mar. 1976 7 p ERTS

(E76-10359; NASA-CR-147929) Avail: NTIS HC \$3.50 CSCL 08H

The author has identified the following significant results. From real time data, an intense storm with temperatures in the mid fifties was seen moving through New England. Approximately \$33 million in damages were prevented because of the advance warning, and no damage was incurred in northern Maine as a result.

N76-25616*# Geological Survey, Reston, Va.

DYNAMICS OF TURBIDITY PLUMES IN LAKE ONTARIO Final Report, 1 Jul. 1972 - 31 Dec. 1974

Edward J. Pluhowski, Principal Investigator 1 May 1975 71 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(NASA Order S-70243-AG)

(E76-10370; NASA-CR-147963; Rept-75-249) Avail: NTIS HC \$4.50 CSCL 08H

The author has identified the following significant results. Large turbidity features along the 275 km south shore of Lake Ontario were analyzed using LANDSAT-1 images. The Niagara River plume, ranging from 30 to 500 sq km in area is, by far,

the largest turbidity feature in the lake. Based on image tonal comparisons, turbidity in the Welland Canal is usually higher than that in any other water course discharging into the lake during the shipping season. Less turbid water enters the lake from the Port Dalhousie diversion channel and the Genesee River. Relatively clear water resulting from the deposition of suspended matter in numerous upstream lakes is discharged by the Niagara and Oswego Rivers. Plume analysis corroborates the presence of a prevailing eastward flowing longshore current along the entire south shore. Plumes resulting from beach erosion were detected in the images. Extensive areas of the south shore are subject to erosion but the most severely affected beaches are situated between Fifty Mile Point, Ontario and Thirty Mile Point, New York along the Rochester embayment, and between Sodus Bay and Nine Mile Point.

N76-25618*# National Oceanic and Atmospheric Administration, Washington, D.C.

EVALUATION OF LANDSAT-2 DATA FOR SELECTED HYDROLOGIC APPLICATIONS Progress Report

Donald R. Wiesnet and David F. McGinnis, Principal Investigators 16 Jun. 1976 3 p ref ERTS

(Contract NAS5-35991)

(E76-10373; NASA-CR-147966) Avail: NTIS HC \$3.50 CSCL 08H

N76-25625*# Geological Survey, Sioux Falls, S. Dak.

LINEAMENTS ON SKYLAB PHOTOGRAPHS: DETECTION, MAPPING, AND HYDROLOGIC SIGNIFICANCE IN CENTRAL TENNESSEE Final Report

Gerald K. Moore, Principal Investigator 1976 87 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(NASA Order H-2810-B)

(E76-10380; NASA-CR-144490; Rept-76-196) Avail: NTIS HC \$5.00 CSCL 08B

The author has identified the following significant results. Lineaments were detected on Skylab photographs by stereo viewing, projection viewing, and composite viewing. Sixty-nine percent more lineaments were found by stereo viewing than by projection, but segments of projection lineaments are longer; total length of lineaments found by these two methods is nearly the same. Most Skylab lineaments consist of topographic depression: stream channel alignments, straight valley walls; elongated swales, and belts where sinkholes are abundant. Most of the remainder are vegetation alignments. Lineaments are most common in dissected areas having a thin soil cover. Results of test drilling show: (1) the median yield of test wells on Skylab lineaments is about six times the median yield of all existing wells; (2) three out of seven wells on Skylab lineaments yield more than 6.3 l/s (110 gal/min); (3) low yields are possible on lineaments as well as in other favorable locations; and (4) the largest well yields can be obtained at well locations of Skylab lineaments that also are favorably located with respect to topography and geologic structure, and are in the vicinity of wells with large yields.

N76-25637*# Marine Environmental Sciences Consortium, Dauphin Island, Ala.

MOBILE BAY TURBIDITY PLUME STUDY Report, 1 Apr. 1975 - 31 Mar. 1976

George F. Crozier 14 Apr. 1976 44 p refs

(Contract NAS8-30810)

(NASA-CR-144331) Avail: NTIS HC \$4.00 CSCL 08J

Laboratory and field transmissometer studies on the effect of suspended particulate material upon the appearance of water are reported. Quantitative correlations were developed between remotely sensed image density, optical sea truth data, and actual sediment load. Evaluation of satellite image sea truth data for an offshore plume projects contours of transmissivity for two

different tidal phases. Data clearly demonstrate the speed of change and movement of the optical plume for water patterns associated with the mouth of Mobile bay in which relatively clear Gulf of Mexico water enters the bay on the eastern side. Data show that wind stress in excess of 15 knots has a marked impact in producing suspended sediment loads. G.G.

N76-25638# Northeastern Forest Experiment Station, Upper Darby, Pa.

MUNICIPAL WATERSHED MANAGEMENT SYMPOSIUM PROCEEDINGS

1975 200 p refs Symp. held at University Park, Pa., 11-12 Sep. 1973 and at Durham, N. H., 19-20 Sep. 1973 (NE-13) Avail: NTIS HC \$7.50

A report on the Symposium held in September 1973 at Pennsylvania State University and University of New Hampshire, containing 24 papers presented at the meeting. Topics discussed are: (1) water quality as affected by timber clearing, (2) U.S. Public-Health Standards for potable water, (3) recreational activity effects on water quality, (4) soil conservation measures, and current management practices now employed in various states. Photographs of water purification facilities in current use in various states are shown. Author

N76-25647# Nevada Univ., Reno. Center for Water Resources Research.

A REVIEW AND SYNTHESIS OF THE BIOT AND JACOB-COOPER THEORIES OF GROUND-WATER MOTION

Hydrology and Water Resources Technical Report

Richard L. Cooley Oct. 1975 95 p refs

(Contract DI-14-31-0001-5028)

(PB-249467/2; H-W-Pub-25; W76-04003;

OWRT-A-058-NEV(1)) Avail: NTIS HC \$5.00 CSCL 08H

The Biot theory of flow in elastic porous media was reviewed and was found to be capable of describing general problems involving unsteady-state ground-water motion. Nonlinearity of the stress-strain relations, finite strain, anisotropy and heterogeneity of the porous medium, and general boundary conditions are all contained in the theory. Because the stress-strain relations were all obtained from free energy expressions, anelastic problems can be analyzed by approximations of the types often used in soil mechanics and other fields of solid mechanics. GRA

N76-26623*# National Oceanic and Atmospheric Administration, Rockville, Md. Office of Aeronautical Charting and Cartography.

ERTS IMAGERY AS DATA SOURCE FOR UPDATING AERONAUTICAL CHARTS Interim Report, period ending Mar. 1976

Joe F. Wilson, Principal Investigator Apr. 1976 27 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(NASA Order S-53965-A)

(E76-10395; NASA-CR-148182) Avail: NTIS HC \$4.00 CSCL 08B

N76-26645* Colorado State Univ., Fort Collins.

WATER RESOURCES, SUMMARY

D. B. Simons In NASA, Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 151-171

CSCL 08H

The application of remote sensing products to the development and understanding of water resources problems is considered. Geology and hydrogeology, analysis of watersheds, snow and ice, prediction of runoff from snowmelt, hydrologic land use classifications, soil moisture, evapotranspiration, flood hazards, and water quality surveys are among the topics discussed. Suggestions for further use of remotely sensed data are given along with increased user requirements. J.M.S.

N76-26729# Minnesota Univ., Minneapolis. Water Resources Research Center.

STUDIES ON THE EFFECTS OF THERMAL ADDITIONS ON SELECTED ZOOPLANKTON POPULATIONS

Wayland R. Swain, Robert M. Wilson, and R. Peter Neri Nov. 1975 96 p refs

(PB-249497/9; WRRR-Bull-84; W76-04012;

OWRT-B-097-Minn) Avail: NTIS HC \$5.00 CSCL 06F

The objective was to examine the effects of calefaction upon members of the animal portion of the Lake Superior ecosystem. Additionally, certain species which are widely available were also utilized in order to establish a point of reference which could be used by workers in other parts of the country. The method described here utilized the establishment of an artificial segment of Lake Superior in a carefully controlled laboratory setting which could be modified at will in order to observe the impacts of each change upon the test organism or community. Critical to this study was a method of observation of organism behavior which allowed remote monitoring of the population, but did not alter the environment of the test animals. GRA

N76-27626*# Texas A&M Univ., College Station. Remote Sensing Center.

SPECTRAL MEASUREMENT OF WATERSHED COEFFICIENTS IN THE SOUTHERN GREAT PLAINS Progress Report, Mar. - May 1976

Bruce J. Blanchard, Principal Investigator Jun. 1976 8 p ERTS

(Contract NAS5-22534)

(E76-10407; NASA-CR-148214; RSC-3273-3) Avail: NTIS HC \$3.50 CSCL 08H

N76-27636*# ECON, Inc., Princeton, N.J.

A PARAMETRIC STUDY OF THE VALUE OF HYDROLOGICAL INFORMATION FOR IRRIGATION AND HYDROPOWER MANAGEMENT OF THE FEATHER RIVER Final Report

Elliot Wetzler, Francis Sand, Peter Stevenson, and Martin Putnam 30 Aug. 1975 246 p refs

(Contract NASw-2558)

(NASA-CR-148157; Rept-75-127-5) Avail: NTIS HC \$8.00 CSCL 08H

A case study analysis is presented of the relationships between improvements in the accuracy, frequency, and timeliness of information used in making hydrological forecasts and economic benefits in the areas of hydropower and irrigation. The area chosen for the case study is the Oroville Dam and Reservoir. Emphasis is placed on the use of timely and accurate mapping of the aerial extent of snow in the basin by earth resources survey systems such as LANDSAT. The subject of benefits resulting from improved runoff forecasts is treated in a generalized way without specifying the source of the improvements. Author

N76-27651*# Scientific Translation Service, Santa Barbara, Calif. **STUDY OF WATER RESOURCES WITH THE AID OF SPACECRAFT IN THE UNITED STATES**

L. V. Dunin-Barkovskiy Washington NASA Jul. 1976 18 p refs Transl. into ENGLISH from Vod. Resursy (USSR), no. 1, 1976 p 60-68

(Contract NASw-2791)

(NASA-TT-F-17112) Avail: NTIS HC \$3.50 CSCL 08H

Results of research using remote sensing for studying water resources in the United States are examined. Manned and artificial earth satellites are used. Author

N76-27662# Florida Univ., Gainesville.

A HYDROLOGIC STUDY OF A SMALL SUBURBAN WATERSHED

M. W. Anderson and B. E. Ross Oct. 1975 96 p refs Prepared in cooperation with Univ. of South Florida, Tampa (Contract DI-14-31-0001-5009) (PB-249744/4; WRRP-Pub-31) Avail: NTIS HC \$5.00 CSCL 08H

A 126 acre tract of land in a natural undisturbed state, and adjacent 239.3 acres that made up the watershed, were instrumented in November, 1971, in order to determine the effect of development on the hydrology. Hydrologic quantity and quality data were collected until April, 1975. The tract, which is located in Tampa, Florida, did not experience the planned extensive development due to financial problems of the developer. Consequently, the anticipated major hydrologic changes did not occur. However, significant alterations to the natural drainage pattern of the property were made and these caused changes in the runoff quality which were documented. Data were obtained pertaining to: (1) the changes in runoff quality during a storm, (2) the yearly variation of runoff quality from a partially developed watershed, (3) the lack of change in quality of ground water in the surface aquifer, and (4) the purification of urban runoff by routing it over a natural vegetative system. The study confirmed that disturbing marshes or lakes cause a significant increase in suspended solids and nutrient content in runoff, especially phosphates. GRA

DATA PROCESSING AND DISTRIBUTION SYSTEMS

Includes film processing, computer technology, satellite and aircraft hardware, and imagery.

A76-30240 * Use of ERTS-1 imagery to interpret the wind erosion hazard in Nebraska's Sandhills. P. M. Seevers, D. T. Lewis, and J. V. Drew (Nebraska, University, Lincoln, Neb.). *Journal of Soil and Water Conservation*, vol. 30, July-Aug. 1975, p. 181-183. 8 refs. Contract No. NAS5-21756.

A76-30747 A note on SAR imagery of the ocean. T. R. Larson (Ball Brothers Research Corp., Boulder, Colo.), L. I. Moskowitz, and J. W. Wright (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *IEEE Transactions on Antennas and Propagation*, vol. AP-24, May 1976, p. 393, 394, 5 refs.

An example of SAR imagery of the ocean surface including the Gulf Stream Boundary reported by Moskowitz (1973) is used to discuss potential mechanisms of SAR image formation of the ocean. It is pointed out that images in addition to those due to modulation of surface scatterer strength may result from organized scatterer motions such as those due to currents or wave orbital velocities. The modulation of scattering cross section by large waves is expected to depend on the magnitude and direction of the wind, making the relationship between image strengths and wave amplitudes rather complicated. It is suggested that the effect of wave orbital accelerations upon azimuthal focus might provide a more direct measure of wave amplitude. (Author)

A76-31006 # Methods for measurement of natural resources with the aid of TV images from meteorological satellites (Metodika izmereniia prirodnnykh resursov po TV izobrazheniiam s meteorologicheskikh ISZ). B. V. Vinogradov (Akademiia Nauk SSSR, Institut Geografii, Moscow, USSR) and A. B. Vinogradov (Glavnoe Upravlenie Gidrometeorologicheskoi Sluzhby SSSR, Institut Okeanografii, Moscow, USSR). *Meteorologiya i Gidrologiya*, Feb. 1976, p. 48-53. 10 refs. In Russian.

Direct field testing of satellite TV images with the resolution element of several square kilometers is practically impossible because of the high spatial and temporal variations of natural factors. The paper describes two-stage methods for measurement of natural factors utilizing characteristic curves of TV images and the spectral brightness coefficient of natural formations. It is proposed to use the spectral brightness coefficient as a binding link in the measurement of natural factors from the density of TV negatives. (Author)

A76-31274 The dependence of a number of texture parameters, obtained by the digital evaluation of aerial photos, on image position and terrain relief (Abhängigkeit einiger durch digitale Auswertung von Luftbildern gewonnener Texturparameter von Bildort und Geländere relief). J. Schade. *Bildmessung und Luftbildwesen*, vol. 44, May 1, 1976, p. 89-94. 9 refs. In German.

A76-31275 Identification and elimination of errors in the controlled classification of multispectral image data (Identifizierung und Behebung von Fehlern bei der kontrollierten Klassifikation multispektraler Bilddaten). R. H. Dittel (Zentralstelle für Geophotogrammetrie und Fernerkundung, Munich, West Germany). *Bildmessung und Luftbildwesen*, vol. 44, May 1, 1976, p. 99-107. 8 refs. In German.

The procedural steps of a controlled classification process are

briefly considered, taking into account the selection of relevant image elements representing a surface, the statistical description of the individual surface classes, and the determination of the allocation probability for image elements. Errors occur in each of the procedural steps. Attention is given to systematic errors related to the natural spectral characteristics, process-related errors, and errors connected with application-related requirements and surface-unrelated characteristics. G.R.

A76-31426 Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports (Symposium über Erderkundung, Porz-Wahn, West Germany, April 7-11, 1975, Vorträge). Symposium sponsored by the Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Deutsche Gesellschaft für Photogrammetrie, and Deutsche Forschungsgemeinschaft. Cologne; Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975. 717 p. In German and English.

The papers deal with various methods used in earth surveys and earth resource surveys. The topics discussed cover the techniques used in image analysis; image interpretation; surface temperature measurements by radiometer and other techniques; and remote sensing by IR radiometry, side looking airborne radar, and digital multispectral scanning techniques. V.P.

A76-31428 # Physical fundamentals of remote sensing (Physikalische Grundlagen der Fernerkundung). H.-J. Bolle (München, Universität, Munich, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 11-24. 18 refs. In German.

Remote sensing (Fernerkundung) is understood to mean the extraction of information on some object from mono- and multispectral radiant energy density measurements. The physical principles of radiation transfer in inhomogeneous media are analyzed, and the optical properties of natural surfaces are studied and identified. V.P.

A76-31430 # Method of interpreting aerial photographs (Über die Methode der Luftbildinterpretation). J. Albertz (Karlsruhe, Universität, Karlsruhe, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 47-56. 5 refs. In German.

The elements of optical perception are examined in the light of their importance to the interpretation of aerial photographs. The type and amount of information that can be acquired on an image from such factors as the brightness of a surface; the shape and size of objects; the texture of surfaces; shadings, tints, or cast shadows; patterns formed by objects; the relative position of objects; and the stereoscopic effect are discussed. V.P.

A76-31431 # Analog-optical and digital-electric image processing (Analog-optische und digital-elektrische Bildverarbeitung). B. Bargel (Forschungsinstitut für Informationsverarbeitung und Mustererkennung, Karlsruhe, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 57-72. In German.

The state of the art of automatic image processing in the field of remote prospecting is briefly reviewed. Due to the complexity of the problems involved, the discussion is limited to those aspects that are important for remote sensing. The principles of analog-optical and digital-electric processing are discussed, and example applications of these techniques are given. V.P.

A76-31433 # Fundamentals and problems of infrared radiometry in remote sensing (Grundlagen und Probleme der Infrarot-Radiometrie in der Fernerkundung). D. Lorenz (Deutscher Wetterdienst, Agrarmeteorologische Forschungsstelle, Bad Godesberg, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West

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Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 89-97. In German.

The application of IR line scanners, built on the basis of cooled semiconductor photodetectors, to airborne imaging at wavelengths up to approximately 15 microns is examined. Some aspects of the use of this technique in remote sensing of the earth's surface are discussed, along with methods of correcting for interference effects.

V.P.

A76-31434 # Applications of radiometric surface-temperature measurements in earth surveys (Anwendungen der radiometrischen Oberflächentemperaturmessung bei der Erderkundung). D. Lorenz (Deutscher Wetterdienst, Agrarmeteorologische Forschungsstelle, Bad Godesberg, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports.

Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 99-112. 9 refs. In German.

The degree of information available from IR thermometer measurements and IR line scanner photographs is discussed with a view toward the application of IR radiometry to remote sensing of the earth. The utility of these techniques under various meteorological conditions is demonstrated on the basis of actual measurements and photographs.

V.P.

A76-31439 # Classification of multispectral data by means of digital methods (Klassifizierung multispektraler Daten mit Hilfe digitaler Verfahren). R. H. Dittel, J. Bodechtel, and R. Haydn (Zentralstelle für Geophotogrammetrie und Fernerkundung, Munich, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports.

Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 179-203. 9 refs. In German.

Experience obtained with supervised and unsupervised classification is reviewed. It is shown that experience in conventional image evaluation is an important factor for proper system-supported classification and that availability of descriptive statistical data on the spectral behavior of certain surfaces is a prerequisite for cost effective classification. User-oriented unsupervised classification is still uneconomical due to computer time considerations.

V.P.

A76-31440 # Radar techniques for earth surveys (Radarverfahren zur Erderkundung). W. Foggy and F. Schlude (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Flugfunk und Mikrowellen, Oberpfaffenhofen, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports.

Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 205-221. 7 refs. In German.

Starting with a historical survey of the development of radar technology, the principles of operation of microwave radar sensors intended for use in earth resources surveys are discussed. The characteristic of representative survey radars, such as the synthetic aperture side-looking radar and the four-channel simultaneous X-L band imaging radar are examined.

V.P.

A76-31442 # Radar echoing characteristics from natural and artificial objects (Radarrückstrahleigenschaften von natürlichen und künstlichen Objekten). G. Graf, F. Heel, and H. Kietzmann (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Flugfunk und Mikrowellen, Oberpfaffenhofen, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports.

Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 247-260. In German.

An attempt is made to develop criteria for differentiating between the echoing cross sections of various terrestrial formations. It is found that the frequency dependence of the echoing cross section and the absolute value of the echoing cross section are the most effective criteria, whereas the polarization dependence and the angular dependence appear to provide less information.

V.P.

A76-31443 # Microwave radiometry (Mikrowellenradiometrie). K. Grüner (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Flugfunk und Mikrowellen, Oberpfaffenhofen, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports.

Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 261-279. 6 refs. In German.

The fundamentals of passive quantitative measurement of the electromagnetic radiation emitted by objects are outlined. The damping influence of the atmosphere is examined, along with the characteristics of objects in the microwave range. The characteristics of transmitting and receiving antennas are discussed.

V.P.

A76-31450 # Proposal of a concept for the operation and data management of operational earth resources satellites (Konzeptvorschlag für den Betrieb und das Datenmanagement von operationellen Erderkundungssatelliten). W. Gilg and E. Velten (Dornier-System GmbH, Friedrichshafen, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports.

Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 381-392. 6 refs. In German. Gesellschaft für Weltraumforschung Contract No. RV21-V64/74-KA-50.

The paper proposes a concept combining a central system for satellite operational control and a decentralized system for data transmission and processing. The satellite system will be applied to the fields of hydrology and agriculture and will have the following operational specifications ('boundary conditions'): (1) the satellite will be in a sun-synchronous polar orbit 900 km high; (2) the remote sensors will include a multispectral scanner, an infrared scanner and microwave sensors, with the optical instruments having a geometrical resolution of about 30 m with all the sensors operating on 10 or more different channels. The satellite system will contain a network of regional (national) ground stations for receiving remote sensor data and a central ground station for mission control. Data transmission and data processing aspects are discussed in detail with detailed examination of frequency selection, the role of Data Collection Platforms in the system, the treatment of users and user organizations and the structure of the overall system which is conceived will be characterized by the cooperation of international organizations with national organizations.

B.J.

A76-31461 # Digital terrain model (Digitales Geländemodell /DGM/). F. Bauhuber, V. Erlacher, and P. Günther (Messerschmitt-Bölkow-Blohm GmbH, Munich, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, Apr. 7-11, 1975, Reports.

Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 505-518. In German.

An interpolation method using analytical functions for the construction of digital models of different kinds of terrains - in geodesy, geology, cartography and city street mapping - is described. The function value of a position to be determined is obtained through the interpolation from points in the vicinity of that position. In order to save labor so-called 'vicinity-relations' are tabulated for given points near the position to be determined. The interpolation is implemented on a modular program system whose input is the system of points and their vicinity relations and whose output is a graphic representation of the terrain.

B.J.

A76-31463 # Future aspects of image processing in the field of remote sensing (Zukunftsaspekte der Bildverarbeitung für den Bereich der Fernerkundung). P. Hartl (Berlin, Technische Universität, Berlin, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports.

Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 529-545. 6 refs. In German.

The paper reviews various aspects of the digital processing of remote sensor images with particular reference to Landsat-1 multispectral scanner imagery. Image transformation techniques are described together with and feature interpretation and classification

procedures. It is shown that image content can originate in geometry (texture) or brightness (signature). Geometrical image correction procedures are discussed emphasizing linear correction, n -order transformations, complicated distortions and radiometric corrections. Feature enhancement is considered with attention paid to brightness transformation, multispectral image point manipulation, local/nonlocal operations and signature/texture. The supervised and unsupervised classification techniques are described and the current status of digital image processing in the United States is examined.

B.J.

A76-31466 # Analog/digital processing of multispectral data (Analog/digitale Verarbeitung multispektraler Daten). R. Haydn, J. Bodechtel, and R. H. Dittel (Zentralstelle für Geo-Photogrammetrie und Fernerkundung, Munich, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 573-589. 5 refs. In German.

Analog processing, digital processing, and hybrid analog/digital processing of multispectral video data generated in earth sensing operations are reviewed. Color display, image buildup, enhancement, and coding equidensities are dealt with in the discussion of real-time analog processing. Advantages of programmed digital handling are treated, along with automatic classification of multispectral data as multidimensional information, using multivariate statistics. Statistical preprocessing (feature extraction) and statistical ordering (decision making) are covered under automatic classification. Limitations associated with the spectral significance of input data are dealt with, along with analog image mixing and coding, and hybrid systems. Examples of statistical preprocessing (with optimization of multispectral output information) are presented.

R.D.V.

A76-31469 # Processing and dissemination of earth survey satellite data - Report on the activity of the IAF Working Group I (Processing and dissemination of earth survey satellite data - Bericht über Tätigkeit der IAF Working Group I). H. Sax (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Zentralabteilung Raumflugbetrieb, Oberpfaffenhafen, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 621-636. 5 refs. In German.

The characteristics of currently operating and planned earth survey satellites are reviewed, along with the individual missions, sensing equipment, orbital parameters, and data transmission systems. This information is used as a basis to develop the design principles for a ground system that would process and disseminate the data. The principal characteristics of operating and planned ERTS ground stations are examined and compared.

V.P.

A76-31471 # Presenting the results of a regional survey for West-Sumatra by computer mapping. K. Völger (Umwelt-Datag GmbH, Offenbach, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports.

Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 653-662.

The characteristics of computer mapping and spectral pattern recognition are examined, and the cellular computer mapping approach, using 1-sq km cells, is described and demonstrated by examples. The degree of generalization is shown to be similar to that of automatic ERTS processing; however, many more (economical and sociological) sectors can be covered. The resulting maps are very similar to thematic maps from multispectral scanners using computer-aided spectral pattern recognition techniques.

V.P.

A76-31700 # Analysis of the construction of geometrical landscape models from aerial photographs (Analiz postroeniia po aerofotosnimkam geometricheskoi modeli mestnosti). Iu. S. Tiufilin (Tsentral'nyi Nauchno-Issledovatel'skii Institut Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR). *Geodeziia, Kartografiia i Aerofotos'emka*, no. 22, 1975, p. 101-107. In Russian.

Some aspects of the application of vector-matrix and correlation analysis to the construction of geometrical models of landscapes from aerial photographs are examined, and the computed correlation matrices and rms errors of the three-dimensional coordinates of points of a model are tabulated, along with the eigenvalues of the covariant matrices. It is shown that the determined three-dimensional coordinates of points may not be treated as uncorrelated quantities in subsequent photogrammetric processes.

V.P.

A76-31879 # Interkosmos laser radar network. A. G. Masevitsch and K. Hamal (Ceske Vysoke Ucení Technické, Prague, Czechoslovakia). In: Laser tracking instrumentation; Proceedings of the Second Workshop, Prague, Czechoslovakia, August 11-16, 1975. Prague, Ceske Vysoke Ucení Technické, 1975, p.

32-38. 6 refs.

The paper describes a network of three laser radar stations which was built to carry out several projects in geodesy and geophysics. The network includes a fixed station located at Poznan, Poland, a mobile station at Helwan, Egypt, and a modularized airborne station. The major components of the radars are briefly discussed, and an advanced station is noted which uses a ruby laser and has a time resolution of better than 0.3 nsec.

F.G.M.

A76-32415 Space technology applied to surveying and mapping. G. C. Hughes (TRW Navigation and Computer Systems Laboratory, Redondo Beach, Calif.). In: International Symposium on Space Technology and Science, 11th, Tokyo, Japan, June 30-July 4, 1975, Proceedings. Tokyo, AGNE Publishing, Inc., 1975, p. 837-842. 12 refs.

Geodetic requirements and operational constraints for a proposed system are listed and the translation of the surveying and mapping requirements into one or more navigational parameters is considered. A brief description is given of the basic categories of navigation techniques, taking into account pure inertial systems, noninertial systems, onboard aided inertial systems, and offboard aided inertial systems. Aspects of system definition are discussed, giving attention to an inertial measurement unit, gyro errors, initialization errors, a gravity measurement unit, a height measurement unit, and questions of postflight processing.

G.R.

A76-32424 Characteristics of multi-spectral images obtained from space around Japan. K. Tsuchiya, H. Nakamura, T. Iwata (National Space Development Agency of Japan, Tokyo, Japan), and H. Ochjai (Toba National Merchant Marine College, Toba, Mie, Japan). In: International Symposium on Space Technology and Science, 11th, Tokyo, Japan, June 30-July 4, 1975, Proceedings. Tokyo, AGNE Publishing, Inc., 1975, p.

903-908. 7 refs. Translation.

Two subjects are covered in the report, the global spectral reflectance and reflected energy in four spectral ranges of Landsat-1 MSS data for selected sample areas, and a methodology to find a prevailing orientation and wavelength in a scalar field which is applicable to Landsat data. It is found that the global reflectance of a mountain area with thick forest (15 to 19.5%) is nearly equal to that of the urban area. The small value of reflectance in the shorter wavelength is compensated by the large value in near IR spectra. The method developed by the authors suggests a good possibility of finding a geological feature.

(Author)

A76-32429 * Computer-aided analysis of Skylab scanner data for land use mapping, forestry and water resource applications. R. M. Hoffer (Purdue University, West Lafayette, Ind.). In: International Symposium on Space Technology and Science, 11th, Tokyo,

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Japan, June 30-July 4, 1975, Proceedings.
Tokyo, AGNE Publishing, Inc., 1975, p. 935-941. 7 refs. Contract No. NAS9-13380.

Skylab data were obtained over a mountainous test-site containing a complex association of cover types and rugged topography. The application of computer-aided analysis techniques to the multispectral scanner data produced a number of significant results. Techniques were developed to digitally overlay topographic data (elevation, slope, and aspect) onto the S-192 MSS data to provide a method for increasing the effectiveness and accuracy of computer-aided analysis techniques for cover type mapping. The S-192 MSS data were analyzed using computer techniques developed at Laboratory for Applications of Remote Sensing (LARS), Purdue University. Land use maps, forest cover type maps, snow cover maps, and area tabulations were obtained and evaluated. These results compared very well with information obtained by conventional techniques. Analysis of the spectral characteristics of Skylab data has conclusively proven the value of the middle infrared portion of the spectrum (about 1.3-3.0 micrometers), a wavelength region not previously available in multispectral satellite data. (Author)

A76-32433 # The current technology of high speed digital techniques as applied to earth resources data processing and information extraction. G. P. Fishman and W. Guard (General Electric Co., Space Div., Philadelphia, Pa.). In: International Symposium on Space Technology and Science, 11th, Tokyo, Japan, June 30-July 4, 1975, Proceedings. Tokyo, AGNE Publishing, Inc., 1975, p. 967-976.

A76-33190 # Applicability of a systematic air photo-interpretation procedure for the preparation of large scale soil maps. P. M. Jawade and T. R. Srinivasan (Indian Photo-Interpretation Institute, Dehra Dun, India). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 157-163.

A76-33198 # On the optimization of the photo-interpretation-remote sensing processes and their applications in the wetlands - The Danube Delta. N. C. Oprescu, V. Calistru, D. Rosculeț, and L. Turdeanu (College of Civil Engineering, Bucharest, Rumania). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 273-285. 13 refs.

A76-33199 # Some possibilities of operational calibration of the photo-interpretation-remote sensing data: Some applications in the wetlands - The Danube Delta. N. C. Oprescu, M. Albota, G. Corcodel, and D. Radulescu (College of Civil Engineering, Bucharest, Rumania). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 287-297. 14 refs.

A76-33202 # Evaluation of the potential uses of Earth Resources Technology Satellite /ERTS-1/ data for small scale terrain mapping in Canada's north. A. N. Boydell (Geological Survey of Canada, Ottawa, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 329-340.

A76-33208 # Semiautomatic photo interpretation - A test application in a phytocological inventory of the Quebec-Labrador Peninsula (Photo-interprétation semi-automatique - Essai d'application à un inventaire phytocologique dans la péninsule Québec-Labrador). J. P. Ducruc and R. Zarnovican (Environment Canada,

Quebec, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 419-426. In French.

A microdensitometric analysis was carried out on a color infrared photograph of a transect of 1.5 miles including three broad categories of hemiarctic vegetation. The photograph, taken at an altitude of 9570 m, is on a mean scale of 1:100,000. A species list was compiled for each of three sample areas representing tundra, open timber, and dry scrub, and abundance-dominance coefficients were assigned using a modified Braun-Blanquet scale. Some microdensitometric values have been correlated with the physiognomic units described by analysis of the sample tracts. C.K.D.

A76-33216 # Methods of interpretation of aerial photographs in forest inventory and management in the USSR. V. I. Sukhih and S. G. Sinitsin (Ministry of Forestry of USSR, Moscow, USSR). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 535-540. 12 refs.

Methods used in the U.S.S.R. to estimate forest resources and to monitor the extent of damage due to insect infestation and industrial emissions are outlined. False color multispectral photographs facilitate the accurate determination of the boundaries of forest compartment. These photographs, on a scale of 1:15,000, are used in conjunction with ground data to obtain forest estimates. The following relations are determined on the basis of ground measurements at test sites considered typical of the forest under investigation: crown diameter to diameter at breast height; height and diameter at breast height; total height to the height at which the crown diameter is greatest; crown density to crown stock. The number of trees counted at the test site is compared with the number visible in an aerial photograph. Stereoscopic analyses of the photographs are then carried out to determine the difference in absolute parallax, from which tree height estimates are derived. Correlations between the density, height, and diameter of crowns permit calculation of trunk diameter. Special techniques based on this method are applied in the case of forests in dry or mountainous areas. C.K.D.

A76-33218 # Satellite imagery applied to earth science in Canada. V. R. Slaney (Geological Survey of Canada, Ottawa, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 555-571.

The problems of interpreting monochrome ERTS imagery are considered and compared with the two types of color image produced in Canada. In mosaic form ERTS imagery will be used for broad regional studies and also as topographic map underlays for geophysical data. It is generally recognized that there is a need in Canada for small scale imagery to assist geologists in mapping programs, particularly at 1:250,000 scale. Because of its limited ground resolution, it appears probable that ERTS imagery will be only partially satisfactory for this purpose. (Author)

A76-33219 # Electronic enhancement of satellite imagery and photo interpretation in oil, gas and mineral exploration. C. C. Reeves, Jr. (Texas Tech University, Lubbock, Tex.). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 573-582.

Electronic enhancement of standard aerial photographs and satellite imagery, employing a 32-color density slicer, edge-enhancer and the X-Y monitor, has been used with outstanding success in areas where the distribution of oil, gas and metallic mineralization is controlled by fractures or conjugate lineament intersections. Such methods, almost without exception, reveal lineaments not found

during normal photo interpretation or by field studies. A cost/benefit analysis indicates at least a 100-fold reduction in exploration costs when such electronic methods are used in place of more conventional reconnaissance methods. (Author)

A76-33220 # Analogic techniques of data-enhancement applied in the study of geologic and geothermal features of test-sites in the Italian region /central Alps and volcanic areas/ illustrated by the images from ERTS-1 and other remote sensing platforms. G. M. Lechi, A. M. Tonelli (CNR, Laboratorio per la Geofisica della Litosfera, Milan, Italy), and C. M. Marino (Milano, Università, Milan, Italy). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 583-596. 8 refs.

A76-33221 # ERTS-1 imagery - The valuable tool of geoscientists. S. Palabekiroglu (Ministry of Natural Resources, Ontario Centre for Remote Sensing, Toronto, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 597-609. 7 refs.

Every ERTS-1 image is dominated by patterns and features which can be identified as types of landforms related to the geology and geomorphology of a certain area. The regional or synoptic aspect of an ERTS-1 image makes possible physiographic or geomorphic studies that can range from classifications to determinations of causative interrelationships. Spectral analysis of multitemporal data is used to identify and map regional terrain changes, lineaments, glacial features, and bedrock pattern, which is now valued as an aid in mineral exploration. Cooperative studies between foresters, biologists and geologists for the preparation of maps of surface resources give additional information to geoscientists and planners. (Author)

A76-33222 # The use of ERTS-1 multispectral imagery for geological mapping. H. E. C. van der Meer Mohr (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands), A. M. Rakshit (Geological Survey of India, Jaipur, India), V. D. Bhate (Geological Survey of India, Nagpur, India), and R. P. Sharma (Indian Photo-Interpretation Institute, Dehra Dun, India). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 611-620.

ERTS-1 multispectral imagery of the Montalban area in Spain was analysed by means of standard photo interpretation methods. The study was undertaken to evaluate the usefulness of the system for geological mapping. The interpretation results were compared with existing geological maps and with the results obtained from conventional aerial photographs. The relative merits and disadvantages of the system are discussed. (Author)

A76-33225 # On quantitative image analysis and the study of terrain. H. T. Verstaappen (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 647-665. 31 refs.

Three aspects of quantitative image analysis are distinguished and are discussed separately. Quantitative relief analysis is discussed stressing the possibilities offered by dropped line plots obtained from an orthoprojector. Quantitative analysis based on density characteristics is demonstrated by the study of a sinkhole area using Quantimet equipment. Quantitative analysis based on directional properties is illustrated by an investigation of some terrain features using the technique of optical filtering by way of coherent (laser) light. (Author)

A76-33227 * # Advances in automatic extraction of information from multispectral scanner data. J. D. Erickson (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 683-704. 14 refs. Contracts No. NAS5-21783; No. NAS1-11979; No. NAS9-9784; Grants No. DAAK02-73-C-0438; No. NGR-23-005-552.

The state-of-the-art of automatic multispectral scanner data analysis and interpretation is reviewed. Sources of system variability which tend to obscure the spectral characteristics of the classes under consideration are discussed, and examples of the application of spatial and temporal discrimination bases are given. Automatic processing functions, techniques and methods, and equipment are described with particular attention to those that are applicable to large land surveys using satellite data. The development and characteristics of the Multivariate Interactive Digital Analysis System (MIDAS) for processing aircraft or satellite multispectral scanning data are discussed in detail. The MIDAS system combines the parallel digital implementation capabilities of a low-cost processor with a general purpose PDP-11/45 minicomputer to provide near-real-time data processing. The preprocessing functions are user-selectable. The input subsystem accepts data stored on high density digital tape, computer compatible tape, and analog tape. C.K.D.

A76-33228 # From aerial photograph to satellite image: Methodologies - An example: Pedology (De la photographie aérienne à l'image satellite: Méthodologies - Un exemple: La pédologie). M. C. Girard (Institut National Agronomique Paris-Grignon, Paris, France). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 721-731. 8 refs. In French.

The use of information extracted from satellite imagery, high altitude photographs from stratospheric balloons, and aerial photographs in constructing maps of soil types at different scales is discussed. Examples of the use of each source of information for pedologic analyses are given, and the methodologies used in treating the images and photographs are described. Well defined boundaries between areas with different types of vegetation, as well as information regarding the rock types and hydrography of large areas can be obtained by comparison and superposition of the contrast lines of each channel in satellite imagery. Contrast boundaries can be accurately mapped on a scale of 1/1,000,000, and, in some cases, on a scale of 1/500,000. Analysis of balloon photographs obtained at altitudes of 30-40 km permits the definition of landscape units, areas with distinguishing sets of geological, geomorphological, hydrographic, agronomic, and vegetation traits, and can be enlarged without prejudice to a scale of 1/250,000. Aerial photographs provide precise information on soil components and relationships for very small areas but are a poor means of investigating large scale phenomena. C.K.D.

A76-33229 # Status report on automatic classification of ERTS imagery of Canada. D. Goodenough, J. MacDowall, and R. A. Ryerson (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 733-745. 15 refs.

This paper describes some of the results obtained by government, university, and industrial investigators in developing methodology and applications for automatic classification of ERTS imagery of Canada. The Canada Centre for Remote Sensing (CCRS) receives 80 frames or 1.5 x 10 to the 10th bits of multispectral scanner data per day. Complete ERTS coverage of Canada is obtained every eighteen days. This imagery is particularly beneficial if it can be rapidly and quantitatively analyzed with the final output being maps showing the distribution of various land-use classes and/or tables listing the acreages of each class. University investigators have

concentrated upon software programs for supervised and unsupervised classifications. Government and industrial work has also included the development of man-machine interactive systems for image analysis. (Author)

A76-33230 # ERTS thematic map from multirate digital images. Z. Kalensky (Canadian Forestry Service, Forest Management Institute, Ottawa, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 767-785. 7 refs.

Multirate and multispectral ERTS-1/MSS digital images were combined to produce thematic maps of the Larose Forest test area. Two pattern recognition systems based on the maximum likelihood decision rule were used to classify calibrated earth radiance data into seven subclasses: (1) four-channel system for multispectral classification of images recorded at one date; and (2) twelve-channel system for multirate and multispectral classification of images recorded at three dates. Classified digital images were recorded on computer compatible tapes and printed by an electron beam image recorder to produce separation film transparencies for color photomaps. Digital images were also printed by a line printer and displayed as computer printouts with alphabetically coded subclasses. Estimates of classification accuracy for each thematic map and three subclasses (agricultural, coniferous and deciduous forest) are presented in summary tables. (Author)

A76-33232 # Data compression and data reduction techniques for the visual interpretation of multispectral images. N. J. Mulder (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) and S. A. Hempenius. In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 799-804.

A multi-spectral picture pre-processing technique is being developed, which is generally applicable and which can be implemented on a mini-computer or eventually on an optical device. The linear Principal Component (Karhunen-Loève) transformation is extremely suitable for data compression and thus as a pre-processing technique for visual interpretation. Emphasis is placed on a limited selective sampling of the primary pictures in order to obtain a user-optimized transformation. After gaining sufficient experience, standard PC transformations can be performed by routine for each of the interpretation disciplines. Sampling will then only be needed in exceptional cases or for the refinement of the transformations. The paper outlines the Principal Component theory and a sample strategy is given. No experimental results can be presented as yet. (Author)

A76-33235 # Probabilistic identification keys. W. H. Anderson (Technicolor Graphic Services, Inc., Sioux Falls, S. Dak.). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 829-839.

This paper describes the logic behind the construction and use of probabilistic airphoto identification keys. A hypothetical example is presented which demonstrates the basic statistical framework of their construction. Bayesian probability theory is used to modify a priori information according to the results of densitometric measurements taken from the aerial photographs. This approach is shown to be useful when operating with minimal-level diagnostic differences between candidate identifications. (Author)

A76-33236 # Should stereo slar imagery be preferred to single strip imagery for thematic mapping. B. N. Koopmans (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 841-861. 11 refs.

The principles of height and slope measurements are treated for single-strip imagery and stereo images of side-looking radar. Drainage interpretation of stereo radar imagery and single-strip imagery are compared for different terrain types. Stereo viewing of overlapping radar strips offers considerable advantages over monoscopic viewing for interpretation purposes. Details, from far-range and near-range, are observed simultaneously. Moreover, the three-dimensional picture allows relative altitude correlations (often not possible in single-strip imagery) and increases the interpretability of the radar strips. (Author)

A76-33355 * Radar imaging of ocean surface patterns. W. E. Brown, Jr., C. Elachi, and T. W. Thompson (California Institute of Technology, Jet Propulsion Laboratory, Space Sciences Div., Pasadena, Calif.). *Journal of Geophysical Research*, vol. 81, May 20, 1976, p. 2657-2667. 23 refs. Contract No. NAS7-100.

The paper presents some examples of imaging radar oceanographic observations and discusses physical phenomena on the surface that may cause the radar image. The different ocean scattering theories are briefly discussed, including the tangent plane model, the Bragg-Rice model, and the Rayleigh scattering model. All but one of the images presented were obtained with an L-band HH-polarized radar; they include deep-ocean swells, coastal swells, wave refractions, internal waves, ship wakes, abrupt transitions in open-ocean surface roughness, surface slicks, island wind shadowing, and currents. Analyses are shown to suggest that the primary source of the L-band imagery of ocean surface patterns is the variation of small-scale surface roughness and local tilt angle. It is also noted that surface irregularities behave as isotropic scatterers for a radar wavelength of 25 cm. F.G.M.

A76-33574 A model of the geomagnetic field for 1975. N. W. Peddie and E. B. Fabiano (U.S. Geological Survey, Denver, Colo.). *Journal of Geophysical Research*, vol. 81, May 10, 1976, p. 2539-2542. 8 refs.

A new model of the near-surface geomagnetic main field and its secular variation has been derived. The main field part, a degree 12 spherical harmonic series of 168 internal source terms, was derived from 1248 representative values having a nearly even distribution over the earth. These were created by an intermediate analysis of approximately 100,000 reduced original observations made since 1939. The secular variation part, a series of 80 linear time terms, was derived from observatory data exclusively. The model is the basis for the 1975 edition of the U.S. World Magnetic Charts. (Author)

A76-34018 # The high-accuracy T-MP field proton magnetometer (Polevoi protonnyi magnitometr povyshennoi tochnosti T-MP). S. I. Maksimovskikh and V. A. Shapiro (Akademiia Nauk SSSR, Institut Geofiziki, Sverdlovsk, USSR). *Geomagnetizm i Aeronomiia*, vol. 16, Mar.-Apr. 1976, p. 389-391. 10 refs. In Russian.

The T-MP field proton magnetometer was developed to make highly accurate measurements of secular variations of the geomagnetic field and for use in geodynamics research. This paper assesses the response of the magnetometer to various error sources which include: (1) remanent magnetization of the sensor; (2) transient processes in the coil; (3) precessional frequency shift due to disturbance of the circuit activating the sensor; (4) shift in the maximum of the spectral density of the signal after passing through the resonance cascades of the amplifier; (5) sensor and amplifier noise; (6) thermal drift of the frequency of the reference quartz oscillator; and (7) time lag of signal transmission in the logical elements. B.J.

A76-34049 # Side-looking interferometer (Interferometr bokovogo obzora). B. A. Dubinskii. *Radiotekhnika i Elektronika*, vol. 21, Apr. 1976, p. 888, 889. In Russian.

The paper discusses the use of an airborne two-element interferometer for passive scanning of high-radio-contrast sources on

the surface such as individual objects on the sea surface, certain natural formations, fires, etc. The interferometer base is directed along the tangent to the flight path, and observation is carried out with the axis of the interferometer radiation pattern fixed in the plane perpendicular to the base line, on one side of the flight path. The response of a correlation interferometer to a point source is a narrow-band fluctuation whose average frequency and bandwidth are determined by the product of the average frequency and width, respectively, of the spatial power spectrum of the radiation pattern with the source angular velocity. Some basic relations are given concerning range uncertainty, azimuthal source resolution, and equal accuracy in both coordinates at all points of the scanned area. P.T.H.

A76-34173 * **Applied photo interpretation for airbrush cartography.** J. L. Inge and P. M. Bridges (U.S. Geological Survey, Flagstaff, Ariz.). *Photogrammetric Engineering and Remote Sensing*, vol. 42, June 1976, p. 749-760. 7 refs. NASA Order W-13709.

New techniques of cartographic portrayal have been developed for the compilation of maps of lunar and planetary surfaces. Conventional photo interpretation methods utilizing size, shape, shadow, tone, pattern, and texture are applied to computer processed satellite television images. The variety of the image data allows the illustrator to interpret image details by inter-comparison and intra-comparison of photographs. Comparative judgements are affected by illumination, resolution, variations in surface coloration, and transmission or processing artifacts. The validity of the interpretation process is tested by making a representational drawing by an airbrush portrayal technique. Production controls insure the consistency of a map series. Photo interpretive cartographic portrayal skills are used to prepare two kinds of map series and are adaptable to map products of different kinds and purposes. (Author)

A76-34175 **Aerial photo-interpretation techniques for classifying urban land use.** N. C. Gautam (Indian Photo-Interpretation Institute, Dehra Dun, India). *Photogrammetric Engineering and Remote Sensing*, vol. 42, June 1976, p. 815-822. 6 refs.

An effort to map the urban land-use of Bikaner City, India, using aerial photo-interpretation techniques is described. An attempt is made to evolve suitable land-use classification for an Indian urban situation and to test the existing land-use classification scheme. The approach is basically functional and tries to show how the physical character of land-use classes can be recognized from aerial photographs for the purpose of land-use mapping. The scope of the classification scheme will differ from one study to another depending on the scales of photography and the nature of settlement. In small-scale aerial photography, urban areas can be placed in broad categories whereas on large-scale photography the areas can be classified into small units. (Author)

A76-34445 # **Long-duration balloon flights to measure auroral zone X-rays in 1974.** J. W. Münch, K. H. Saeger, H. Specht, G. Kremser (Max-Planck-Institut für Aeronomie, Lindau über Northeim, West Germany), H. Slamanig, K. Zirm (Österreichische Akademie der Wissenschaften, Institut für Weltraumforschung, Graz, Austria), and W. Riedler (Graz, Technische Universität, Graz, Austria). *SBARMO Bulletin*, vol. 6, Apr. 1976, p. 159-164. Research supported by the Max-Planck-Gesellschaft, Österreichischer Fonds zur Förderung der wissenschaftlichen Forschung, and Swedish Board for Space Activities.

The reported project had the objective to measure simultaneously auroral X-ray fluxes in the local afternoon at different magnetic local times and to compare these observations with particle measurements conducted with the aid of ATS 6. The balloons used in the investigations were launched at Kiruna, Sweden. Under midnight-sun conditions the balloons can be launched at any time of the day and stay at levels of 5 to 10 mb for at least two days. The payloads used for the studies are discussed and a flight report is presented. G.R.

A76-34720 # **Some questions pertaining to the automatic computer interpretation of satellite imagery (Nekotorye voprosy avtomatizatsii deshifirovaniia kosmicheskikh snimkov s ispol'zovaniem EVM).** G. I. Bel'chanskii and M. E. Solomatin. *Geodeziia i Kartografiia*, Apr. 1976, p. 35-39. In Russian.

Several computer algorithms for the automatic preprocessing of low-contrast satellite imagery are examined. The algorithms considered differ in the extent to which they use a posteriori information. The effectiveness of differential assessment of optical densities is determined by the accuracy of the threshold parameters. Threshold values for a given interpretation problem are selected by constructing histograms for fragments of the imagery to be analyzed. The methods described have been used with some success in obtaining information on lineaments. C.K.D.

A76-34936 **Grid-modified polynomial transformation of satellite imagery.** V. Kratky (National Research Council, Ottawa, Canada). *Remote Sensing of Environment*, vol. 5, no. 1, 1976, p. 67-74. 10 refs.

Satellite imagery produced by line scanners and vidicon cameras is radio-transmitted to ground stations and photoreproduced in computer controlled electron- or laser-beam devices. In mapping applications, the geometric distortion of images which inevitably results from these operations can be corrected by a polynomial transformation. A modification of its analytical formulation, which increases the solution efficiency is tested. It is found that the computation time can be significantly reduced and the accuracy of the solution improved. (Author)

A76-35005 # **Interpretation and measurement of multi-channel microwave SAR imagery.** R. W. Larson, P. L. Jackson, R. J. Dallaire, R. Shuchman, and R. Rawson (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 53-64. 10 refs.

A discussion of measurements capability, data manipulation techniques and display methods applicable to multichannel microwave synthetic aperture radar (SAR) systems is presented. Examples of four measurements techniques applied to the ERIM 4-channel microwave SAR system are given. A discussion of the large dynamic range capability of the SAR system is included and examples of 4-channel SAR imagery are presented. (Author)

A76-35008 * # **A thematic mapper performance optimization study.** F. J. Thomson, J. D. Erickson (Michigan, Environmental Research Institute, Ann Arbor, Mich.), K. Koerber (Honeywell, Inc., Lexington, Mass.), and M. J. Harnage (NASA, Johnson Space Center, Houston, Tex.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 85-98.

A six-month systems study of earth resource surveys from satellites was conducted in early 1974. Skylab S-192 Multispectral Scanner (MSS) data were used as a baseline to aid in evaluating the characteristics of future systems using satellite MSS sensors. The study took the viewpoint that overall system (sensor and processing) characteristics and parameter values should be determined largely by user requirements for automatic information extraction performance in quasi-operational earth resources surveys, the other major factor being hardware limitations imposed by state-of-the-art technology and cost. (Author)

A76-35009 # **A practical data-processing system for digital scanner.** M. Takahashi, K. Shimooka, T. Michino, and J. Hata (NAC, Inc., Tokyo, Japan). In: International Symposium on Remote

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Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 99-111.

The paper describes a data processing/handling system, integrated with a digital airborne multispectral scanner, whose purpose is to reduce costs and improve digital scanner performance. The system consists of onboard and ground-based quick look systems, a data format conversion system, and an interactive color display system integrated with a digital computer. The onboard HDDT quick look system converts digital data into an image pattern on a monitor-scope in real time, while the ground-based quick look system operates in the same manner in the playback mode. The data-format conversion system, operated by a small computer, converts HDDT data of selected remote sensing areas into computer compatible tape. B.J.

A76-35011 # Satellite-interrogated data platforms in river and flood forecasting. A. F. Flanders and J. W. Schiesl (NOAA, National Weather Service, Silver Spring, Md.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 131-138.

The SMS/GOES satellite environmental data collection system is described with particular emphasis on the interrogated data collection platform radio set. The satellite is closely allied with the Automatic Hydrologic Observing System (AHOS) which operates in three communication modes: telephone, land radio, and satellite. Satellite communications are used where no reliable telephone service exists. Hydrological data are transmitted from a remote site through the GOES satellite to a Command and Data Acquisition station at Wallops Island, Virginia. The data are then disseminated to the River Forecast Center and other users. B.J.

A76-35040 # Skylab MSS vs. photography for estuarine water color classification. H. H. Gordon and M. M. Nichols (Virginia Institute of Marine Science, Gloucester Point, Va.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 421-435. 9 refs.

A computer classification is performed on data from the Skylab multispectral scanner (S192) and Earth Terrain Camera (S190 B) for the Rappahannock Estuary in the Chesapeake Bay. A comparison of results indicates a similar water class structure from color film and MSS tapes, but a much better two dimensional chart derived from the MSS. (Author)

A76-35042.* # Water quality indicators obtainable from aircraft and Landsat images and their use in classifying lakes. J. P. Scherz (Wisconsin, University, Madison, Wis.) and J. F. Van Domelen (Norwich University, Northfield, Vt.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 447-460. 9 refs. Grant No. NGL-50-002-127; Contract No. NAS5-20942.

Equations describing the interaction of sunlight and skylight with the surface of a lake, particles in the water to the depth where light is extinguished, and lake bottom are presented, and the use of aircraft and Landsat images to derive water quality indicators on the basis of these interactions is discussed. A very clear, deep lake with a backscatter signal similar to that of distilled water is used as a reference standard. The degree of turbidity of other target lakes is determined by comparing their residual radiance with the clear lake standard and with the residual radiance of a lake whose turbidity has been determined from water samples. The relative and absolute strengths of residual radiance are used to determine the type and concentration of suspended material, respectively. Oil slicks are

characterized by an increased specular reflectance component, decreased signal from the underlying water, and added backscatter signal from the oil volume. C.K.D.

A76-35070 # Restoration of Landsat images by discrete two-dimensional deconvolution. R. H. Dye (Bendix Corp., Aerospace Systems Div., Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 725-730.

The two-dimensional point spread function of the Landsat multispectral line scanner is accurately approximated by the combined effects of the optical blue circle, detector size, and presampling low-pass electrical filter. The array of numerical values representing a Landsat image can be regarded as the result of a discrete two-dimensional convolution of the original scene with the Landsat point spread function. Since the point spread function is substantially wider in the along-scan direction and somewhat wider in the cross-scan directions than the corresponding sampling intervals, important improvements in both spatial resolution and radiometric accuracy for small objects can be obtained by application of a suitable deconvolution procedure prior to use of the data for thematic recognition or other processes that are sensitive to radiometric errors. (Author)

A76-35071 # Automatic classification of aircraft and satellite multispectral images using mixed integer programming. M. Rebollo and L. F. Escudero (Madrid, Universidad Autónoma, Madrid, Spain). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 731-744. 18 refs.

The problem of designing either linear or quadratic discriminant surfaces for pattern classification of disjoint and intersecting sets has been formulated as a mixed integer programming problem. In this formulation the model either maximizes an objective function which is a measure of the linear or quadratic separability of the sets or minimizes the overall misclassification error when the sets intersect. The discriminant mixed integer programming model has been tested for accuracy and efficiency in three practical applications: (1) simulated patterns and images, (2) classification of an agricultural area using an aircraft multispectral image (MSS 12 channels), and (3) classification of a Landsat-1 image of northeastern Spain in several land use categories. B.J.

A76-35072.* # A new image enhancement algorithm with applications to forestry stand mapping. E. P. Kan, J. K. Lo (Lockheed Electronics Co., Inc., Houston, Tex.), and R. L. Smelser (U.S. Department of Agriculture, Forest Service, Houston, Tex.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 745-755. 15 refs. Contract No. NAS9-12200.

The theory and applications are presented of a new image enhancement algorithm which refines computer classification maps of multispectral data. The refinement eliminates connected sets smaller than a prespecified size and merges them to the surrounding area. Conventional practices in forestry timber stand mapping requires small geographic areas to be absorbed by surrounding large areas to form homogeneous stands. This homogeneity is often incompatible with the statistical formulation of homogeneity. Elements within a timber stand which should be labeled as one feature often correspond to more than one class mapped by existing computer classification techniques. The new algorithm is designed to postprocess classification maps to result in more usable timber stand maps. The new image enhancement technique is compared with an

accepted neighbor-checking postprocessing technique, demonstrating the superiority of the new technique for forestry stand mapping.

(Author)

A76-35074 # Change detection in multi-sensor images. K. Price and R. Reddy (Carnegie-Mellon University, Pittsburgh, Pa.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 769-776. 10 refs. Contract No. F44620-73-C-0074.

We propose that change detection in images is best done at a symbolic level. A continuous multi-spectral image can be segmented into discrete regions having similar properties and this provides the basic symbolic representation needed for change detection. In this paper we describe a picture segmentation method based on multi-dimensional histogram thresholding, feature extraction, and matching of the regions in two images to determine changes, if any. We illustrate its use in detection of changes in snow cover and the analysis of aircraft imagery of crop land. The results compare favorably to other known results.

(Author)

A76-35081 # The use of remote sensing imagery and the PIOS system in land use studies at the Southern California Edison Company. R. G. Crouch (Southern California Edison Co., Rosemead, Calif.) and J. P. Dangermond (Environmental Systems Research Institute, Inc., Redlands, Calif.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 835-844.

The paper deals with a description of the technical methodology employed in collection and automation of land use data obtained from high-altitude imagery, an explanation of ways in which the land use data are used for forecasting purposes, a discussion concerning joint sponsorship for the data collection, and a set of concepts outlining possible improvements to the information processing components of the program. The primary objective is to develop a land use information system to support electric load growth forecasting and general facilities planning. It is shown that a land use information/forecasting system can serve as a guideline for the definition of comprehensive county, regional, or state land use information and planning systems.

S.D.

A76-35090 # Possible areas of application of remote sensing technology in Sierra Leone - Some preliminary work and immediate application. C. S. Kamara (Njala University College, Freetown, Sierra Leone) and A. H. Gabisi (Department of Geological Surveys, Freetown, Sierra Leone). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 925-929. 11 refs.

A76-35101 # Enhancement of geologic features near Mojave, California by spectral band ratioing of Landsat MSS data. P. M. Merifield, D. L. Lamar (California Earth Science Corp., Santa Monica, Calif.), and J. V. Lamar (Rand Corp., Santa Monica, Calif.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1067-1075. 8 refs. U.S. Geological Survey Contract No. 14-08-0001-13911.

A number of geologic features in the western Mojave Desert are enhanced in spectral ratio images which include Band 4 of Landsat MSS data. Alluvial fans of different ages, which are indistinguishable in single spectral band images, are readily differentiated. Subtle differences in soil color, apparently due to variations in hydrous iron oxide content, are enhanced on the ratio images. Differences in the

density and type of vegetation may also be reflected on the images. Other geologic features enhanced relative to their surroundings include an iron oxide gossan around the once productive Middle Butte mining area and a marble unit presently being quarried for the manufacture of cement. Calcareous and alkaline soils of low fertility are easily distinguished because of their relative dark appearance on the ratio images.

(Author)

A76-35106 # Use of a remote reflectometer and digital data analysis to study phosphate deficiency in spruce trees. R. J. Drewett (Plessey Radar Research Centre, Havant, Hants., England). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1123-1131.

A76-35112 # Computer processing of multispectral observations. S. Anthony, J. N. P. Beers, P. W. H. Blansjaar, and J. van Kuilenburg (Netherlands Interdepartmental Working Community for the Application of Remote Sensing Techniques, Delft, Netherlands). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1179-1187. 16 refs.

An MSS processing system applied to Landsat-1 imagery of Holland is described. Bulk processing is carried out by a PDP11/40 minicomputer; image processing, mapping, and archiving are accomplished by a P1400 general purpose computer. Image point coordinates are obtained by an off-line pencilfollower. Linear combination of channels has proven to be an effective method for preprocessing. A modified and augmented version of an existing MSS classification (Herzog et al., 1973) is used. The supervised classification module uses a minimum-distance-to-mean rule, together with thresholds to avoid inclusion of pixels not belonging to a defined category. The variances of the different classes are taken into account, but covariances are ignored. An iterative clustering method is used to test for homogeneity and to detect discontinuities. A principal component transformation based on the assumption that conservation of variance corresponds to conservation of information is used to obtain synthetic bands by linear combination of original bands. The transformation of individual image points to a map system is accomplished by a program utilizing control points to define piecewise polynomials for adjustment.

C.K.D.

A76-35118 # Comparison of aerial passive gamma and passive microwave techniques for measurement of soil moisture. E. L. Peck, L. W. Larson, R. K. Farnsworth (NOAA, Hydrologic Research Laboratory, Silver Spring, Md.), and T. L. Dietrich (NOAA, River Forecast Center, Fort Worth, Tex.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1235-1243. 9 refs.

A76-35122 * # Remote sensing requirements as suggested by watershed model sensitivity analyses. V. V. Salomonson, A. Rango, J. P. Ormsby (NASA, Goddard Space Flight Center, Greenbelt, Md.), and R. Ambaruch (IBM Corp., Federal Systems Div., Gaithersburg, Md.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1273-1284. 10 refs.

A continuous simulation watershed model has been used to perform sensitivity analyses that provide guidance in defining remote sensing requirements for the monitoring of watershed features and processes. The results show that out of 26 input parameters having meaningful effects on simulated runoff, 6 appear to be obtainable with existing remote sensing techniques. Of these six parameters, 3

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require the measurement of the areal extent of surface features (impervious areas, water bodies, and the extent of forested area), two require the discrimination of land use that can be related to overland flow roughness coefficient or the density of vegetation so as to estimate the magnitude of precipitation interception, and one parameter requires the measurement of distance to get the length over which overland flow typically occurs. Observational goals are also suggested for monitoring such fundamental watershed processes as precipitation, soil moisture, and evapotranspiration. A case study on the Patuxent River in Maryland shows that runoff simulation is improved if recent satellite land use observations are used as model inputs as opposed to less timely topographic map information.

(Author)

A76-35129 # Corps of Engineers applications of Landsat digital data. A. N. Williamson (U.S. Army, Engineer Waterways Experiment Station, Vicksburg, Miss.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1353-1360.

The U.S. Army Engineer Waterways Experiment Station has been studying data from Landsat-1 to determine the feasibility of detecting flow patterns, flushing actions of estuaries, and sediment and pollution dispersion. Techniques were developed to process Landsat computer-compatible-tape data, extract useful information, and present the information in several easily used forms. The automated processing techniques and concepts have broad applicability. This paper discusses how they have been applied to three Corps of Engineers studies.

(Author)

A76-35130 # Some operational uses of satellite retransmission in Canada. R. A. Halliday and I. A. Reid (Environment Canada, Inland Waters Directorate, Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1361-1366.

It is now possible through use of the data collection systems carried by satellites such as Landsat and GOES to obtain near real time water resources data from any location in Canada. These data have been used for flow and flood forecasting and to assist in the conduct of hydrometric surveys. Present programs will be continued and, likely, expanded, depending on the availability of suitable satellite systems.

(Author)

A76-35133 # Infrared imagery analysis of the surface and near-surface hydrology of a gas storage field in Garrett County, Maryland. W. Fisher, Jr. (HRB - Singer, Inc., State College, Pa.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1415-1426. 12 refs.

Results are presented for a study intended to identify and locate fracture traces and surface and near-surface water over a prospective gas storage field in Maryland using airborne thermal IR remote sensing and existing hydrogeologic information. Three basic maps to be used as a guide for the location of drillholes are developed: fracture trace location map, hydrologic feature map, and ground water contour map. It is concluded that IR imaging as a remote sensing technique applied to water feature detection and location is limited to the detection of surface thermal phenomena (streams, springs, etc.) and/or subsurface thermal phenomena (fracture traces) which are manifested as a surface thermal anomaly. The maps of the fracture traces, water features, and ground water table are to be used for preliminary drill site selection only. Final site selection calls for on-site investigation and careful further scrutiny of the IR imagery.

S.D.

A76-35137 # Canadian mapping use of Landsat imagery. E. A. Fleniing (Department of Energy, Mines, and Resources, Topo-

graphical Survey, Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1451-1456.

Landsat imagery has been found to be a useful source of map revision information in the wilderness areas. Maps in these areas require revision when new roads, reservoirs or hydroelectric transmission lines are built. The location and extent of these features can be determined with sufficient accuracy for interim revision of 1:250,000 and 1:50,000 maps from the Landsat imagery. In addition the imagery has proved useful for detecting small Arctic Islands, relief shading and photomapping at small scale.

(Author)

A76-35146 Landsat looks at hometown earth. B. C. Bishop. *National Geographic*, vol. 150, July 1976, p. 140-147.

Photomosaics of the continental U.S. obtained via Landsat satellites 1 and 2 (formerly Earth Resources Technology Satellite - ERTS) are displayed, with descriptions of earth-sensing techniques using the multispectral scanner and data-handling techniques. A 10 x 16 ft photomosaic requires only 569 images taken by satellite, as against 28,000 that would be required in an aerial survey from 60,000 ft. New digital processing and correction techniques designed for the future Landsat-3 are described. Uses for the information conveyed by the Landsat-acquired visual and IR images include: water and marine resources mapping, environment monitoring, land-use planning, forestry, range management, geological mapping, location of earthquake zones, faults, monitoring of forest fires, glacier movement, hydrology mapping, monitoring of weather modification on a regional scale by heavy air pollution, mapping of urban-rural boundaries, and thermographic mapping on a regional scale.

R.D.V.

A76-35714 Infrared scanning for meteorological purposes. D. Lorenz. In: Space activity impact on science and technology. Oxford, Pergamon Press, Ltd., 1976, p. 171-180.

8 refs.

The paper deals with problems of surface temperature mapping by infrared scanning. It is found that for vegetation-covered ground, circular scanning and inclined line scanning are preferable to the common method of line scanning with normal scan plane. For water surfaces, circular scanning of polarized infrared radiation at the Brewster angle seems to be optimum. Additional information is necessary for the identification of terrain for airborne scanning and for the separation of clouds at different altitudes from satellites. It is shown that this can be resolved by convergent scanning and stereoscopic interpretation of the images. Those methods are practical for line scanning as well as for circular scanning.

(Author)

A76-37674 Mask correlation spectrophotometry - Advanced methodology for atmospheric measurements. U. Bonafè, G. Cesari, G. Giovanelli, T. Tirabassi, and O. Vittori (CNR, Bologna, Italy). *Atmospheric Environment*, vol. 10, no. 6, 1976, p. 469-474; Appendix, p. 474. 14 refs. Research supported by the Consiglio Nazionale delle Ricerche and NSF.

An advanced methodology in mask correlation spectrophotometry is presented. By operating the instrument with its oscillating correlation mask placed in two chosen positions, a system of two equations can be solved in terms of the unknown optical depth of the gas. The methodology does not require the comparison of field-instrumentation responses with laboratory calibration curves nor the in situ establishment of an absolute baseline. The relative error associated with each measurement can also be computed. Only a 'normal' UV source of light need be used.

(Author)

A76-37676 The application of correlation spectroscopy to the study of dispersion from tall stacks. M. M. Millan, A. J. Gallant, and H. E. Turner (Department of the Environment, Atmospheric Environment Service, Toronto, Canada). *Atmospheric Environment*, vol. 10, no. 7, 1976, p. 499-511. 13 refs.

Vertically integrated SO₂ cross sections of the plume from a tall stack have been obtained with a dispersive correlation spectrometer. A methodology is described for processing these remotely sensed data to determine plume boundaries, horizontal dispersion coefficients and ground path. In addition, the cross sections are combined to yield some insight into the diffusion process affecting the plume and this information is used to establish the conditions under which calculations of mass flow can be made. (Author)

A76-38015 # A likelihood interpretation of the problem of smoothing geodesic networks (Ob odnoi veroiatnostnoi interpretatsii zadachi uravnivaniia geodezicheskikh setei). Z. S. Khaimov (Moskovskii Institut Inzhenerov Geodezii, Aerofots'emki i Kartografii, Moscow, USSR). *Geodeziia i Aerofotos'emka*, no. 6, 1975, p. 9-19. 9 refs. In Russian.

The problem of smoothing geodesic networks is formulated as the problem of finding estimates for the principal parameters of conditional probability distributions. These parameters include the mathematical expectation, the dispersion, and the correlation functions of the measured quantities and their functions. A formula for the weighted mean that corresponds to a generalized method of least squares is derived. V.P.

A76-38106 # Near real-time transmission of sea-ice satellite imagery. E. Shaw (Canada Centre for Remote Sensing, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 83-91.

A project to demonstrate near real-time facsimile transmission of sea-ice satellite imagery was undertaken during the summer, 1974. NOAA and Landsat images produced on the Quick-Look camera system at Prince Albert were 'faxed' using landlines, geostationary satellite and HF radio circuits to shipping in the Arctic. Useful navigation information was received by the participating ships. Further technology advances will improve this service which is poised to become truly operational. (Author)

A76-38109 # Classification methods and error estimation for multispectral scanner data. M. Goldberg, D. Goodenough, and S. Shlien (Canada Centre for Remote Sensing, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 125-143. 8 refs.

This paper describes methods and procedures which outside investigators may use with the automated processing equipment of the Canada Center for Remote Sensing (CCRS) for the purpose of natural resource exploration and mapping. The image classification systems of CCRS may be used in a supervised mode or in an unsupervised mode. All methods developed can be used interactively with the investigator to take advantage of his intimate knowledge of the terrain. Thus, the resulting classifications correspond as closely as possible to the user's requirements. Different methods and algorithms have been tested on widely varying terrain, such as water, forest, agriculture and urban areas. Methods for error estimation have

been developed and applied to these areas. The results are presented pictorially and in tabular form. (Author)

A76-38112 # Photo-optical contrast stretching of Landsat data for multidisciplinary analyses of the Lake Ontario Basin. A. Falconer, L. C. Myers (Guelph, University, Guelph, Ontario, Canada), M. Deutsch (U.S. Geological Survey, Reston, Va.), and R. Anderson (Spectral Data Corp., Hauppauge, N.Y.). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 173-193. 6 refs. U.S. Geological Survey. Contracts No. 14-08-001-13169; No. 14-08-001-13185.

A76-38113 # Edge enhancement for delimitation of suburban environments. G. O. Tapper (Laurentian University, Sudbury, Ontario, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 195-201.

The technique of edge enhancement of selected Landsat I imagery has proved to be useful for mapping variegated areal phenomena. It is especially utile for delimiting suburban environments. Knowledge of current and future land use patterns for any region are critical to any land planning process, especially in terms of inventorying land use, an integral part of the planning process. Edge enhancement of small scale (spacecraft) imagery can allow cost effective monitoring of land use change for large regions and will be an extremely valuable tool in providing data necessary for effective regional planning. (Author)

A76-38116 # Image processing at the University of Alberta. W. A. Davis (Alberta, University, Edmonton, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 233, 234. National Research Council of Canada Grant No. A-7634.

A computer system for analysis of Landsat I imagery, the digital picture processing system (DIPPS), is designed as an inexpensive and easy-to-handle approach to processing and interpretation of remotely sensed imagery capable of supplanting the more expensive and inflexible digital spectral data system and visual inspection using color additive viewers (analog approach) currently in use. System hardware and software, computer command functions, and applications to data are indicated. The system is based around a PDP-9 computer plus TV camera and photographic camera for hard copy. R.D.V.

A76-38122 # High-altitude colour-IR photographs for evaluating spruce budworm damage in Quebec. J. Beaubien (Department of the Environment, Laurentian Forest Research Centre, Sainte-Foy, Québec, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 281-283. 8 refs.

Since 1970 northeastern North America has experienced a spruce budworm (*Choristoneura fumiferana* (Clem.)) outbreak. In an effort to improve current methods used to estimate the extent of forest insect damage over large areas, a remote sensing study was initiated with high-altitude colour-IR aerial photographs (scale 1:60,000) taken over the Gaspé peninsula in mid-August 1974. Cumulative past feeding was apparent at this period of the summer, as almost all current year chipped needles had fallen. Only very severe damage of one year feeding or more could be identified on the images. Color variations due to stand characteristics such as density, age, length of annual shoot growth, prevent the detection of lighter damage on high-altitude CIR photographs. (Author)

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A76-38130 # The use of maximum information colour enhancement in water quality studies. M. M. Taylor (Defence and Civil Institute of Environmental Medicine, Downsview, Ontario, Canada) and E. J. Langham (Environment Canada, Water Resources Branch, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 359-366.

There is usually a strong correlation between the four spectral bands of Landsat images. This means that any corresponding color composite using three of the bands as primary colors is not optimum for presenting the information contained in the images. Moreover since only three bands may be used in the preparation of color composites an unknown amount of information is lost. The technique described here is a development of previous work and it enables noise to be minimized while the information from all four bands is concentrated sequentially into synthesized images. This procedure has wide application but it is particularly interesting for the study of lakes where there are gradients in the amplitude of one or several superimposed spectral signatures. Its use in the study of Lac St-Jean is described by way of illustration. (Author)

A76-38131 # Digital analysis of multispectral satellite data applied to lake surveillance problems in large hydro electric developments. K. P. B. Thomson (Canada Centre for Remote Sensing, Ottawa, Canada), C. Paré (Ministry of Natural Resources, Quebec, Canada), and M. D. Roy. In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 371-382. 7 refs.

Application of remote sensing to lake classification and definition of limnological characteristics are discussed. Spectral albedo or apparent reflectance, sediment loading differences between groups of lakes, and a shoreline development factor (for assessing effects of littoral zone processes) are singled out as criteria for classification. The study centers on hydroelectric power development projects for the James Bay region. Ratios of apparent reflectance show negligible differences at present, given the limnological characteristics of the region, and any important variation over time would provide a measure of environmental impact by regional development activities. R.D.V.

A76-38141 # A quantitative comparison of color photography and Landsat imagery for a small scale land resource map of northern British Columbia. K. W. G. Valentine (Agriculture Canada, Vancouver, Canada) and J. F. Hawkins (British Columbia, University, Vancouver, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 489-494. Research supported by the British Columbia Department of Agriculture.

N76-22636*# Mitre Corp., McLean, Va.
STRATOSPHERIC MEASUREMENT REQUIREMENTS AND SATELLITE-BORNE REMOTE SENSING CAPABILITIES
J. J. Carmichael, R. G. Eldridge, E. J. Frey, E. J. Friedman, and A. H. Ghovanlou Feb. 1976 223 p refs Sponsored by NASA
(Contract F19628-75-C-0001)
(NASA-CR-144911; MTR-7007) Avail: NTIS HC \$7.75 CSCL 04A

The capabilities of specific NASA remote sensing systems to provide appropriate measurements of stratospheric parameters for potential user needs were assessed. This was used to evaluate the capabilities of the remote sensing systems to perform global monitoring of the stratosphere. The following conclusions were reached: (1) The performance of current remote stratospheric sensors, in some cases, compares quite well with identified measurement requirements. Their ability to measure other species has not been demonstrated. (2) None of the current, in-situ

methods have the capability to satisfy the requirements for global monitoring and the temporal constraints derived from the users needs portion of the study. (3) Existing, non-remote techniques will continue to play an important role in stratospheric investigations for both corroboration of remotely collected data and in the evolutionary development of future remote sensors. Author

N76-22642*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

ON THE ACCESS TO AN EARTH RESOURCES DATA PROCESSING SYSTEM

Terry L. Phillips and Susan K. Schwingendorf 1974 24 p
(Grant NGL-15-005-112)
(NASA-CR-147139; LARS-IN-031274) Avail: NTIS HC \$3.50 CSCL 05B

The Purdue/LARS earth resources data processing system is briefly described. The considerations to which an organization would want to give attention before obtaining a remote terminal to this system are discussed. The support of such a terminal which Purdue/LARS is willing to propose is described. Author

N76-22643*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

AAFE RADSCAT DATA REDUCTION PROGRAMS USER'S GUIDE

John P. Claassen 1976 146 p refs
(Contract NAS1-10048)
(NASA-CR-144992; CRES-TR-186-9) Avail: NTIS HC \$6.00 CSCL 04B

Theory, design and operation of the computer programs which automate the reduction of joint radiometer and scatterometer observations are presented. The programs reduce scatterometer measurements to the normalized scattering coefficient; whereas the radiometer measurements are converted into antenna temperatures. The programs are both investigator and user oriented. Supplementary parameters are provided to aid in the interpretation of the observations. A hierarchy of diagnostics is available to evaluate the operation of the instrument, the conduct of the experiments and the quality of the records. General descriptions of the programs and their data products are also presented. This document therefore serves as a user's guide to the programs and is therefore intended to serve both the experimenter and the program operator. Author

N76-22645# Delft Hydraulics Lab. (Netherlands).

A MORPHOLOGICAL TIME-SCALE FOR RIVERS

M. DeVries Nov. 1975 9 p refs Presented at the 16th Intern. Assoc. for Hydraulic Res. Congr., Sao Paulo, Brazil, Jul. 1975
(Publ-147) Avail: NTIS HC \$3.50

To predict changes in the geometry of a river due to human interference, a morphological time-scale, characterizing processes of degradation (erosion) and aggradation of rivers was defined. Processes of degradation and aggradation of rivers have a speed depending on the characteristics of the river. Starting from the basic transport equation containing the time-depending transport coefficient, a morphological time-scale was established and estimated for various rivers such as the Rhine, the Magdalena (Columbia), the Danube (Hungary), the Tana (Kenya), and the Apure (Venezuela). ESA

N76-22646# Delft Hydraulics Lab. (Netherlands).

COMPUTATIONAL ANALYSIS FOR OPTIMAL BOUNDARY CONTROL OF TWO-DIMENSIONAL TIDAL MODEL

P. VanDerKuur and G. K. Verboom Nov. 1975 9 p refs Presented at the 16th Intern. Assoc. for Hydraulic Res. Congr., Sao Paulo, Brazil, Jul. 1975
(Publ-148) Avail: NTIS HC \$3.50

In order to supply data for the water management of the Rotterdam Waterway Estuary and to investigate an optimum sea boundary control system, various mathematical models describing the tidal propagation are presented and discussed. They include the one- and two-dimensional analytical models and the two-dimensional numerical model. Results of these

mathematical models were in agreement. Further investigations with the numerical model were carried out to find ways to adjust this model to satisfy a good water level and a reasonable horizontal tide seawards of Hook of Holland. ESA

N76-22647# Delft Hydraulics Lab. (Netherlands).
EXPERIMENTAL RESULTS ON EXCHANGE COEFFICIENTS FOR NON-HOMOGENEOUS FLOW

A. J. VanRees Nov. 1975 12 p refs Presented at the 16th Intern. Assoc. for Hydraulic Res. Congr., Sao Paulo, Brazil, Jul. 1975

(Publ-150) Avail: NTIS HC \$3.50

To get an insight into the salinity intrusion phenomena in the Rotterdam Waterway Estuary, a research program on density currents is being carried out in a tidal flume. Data from a series of tests were evaluated on the basis of a two-dimensional analysis, applied for control volumes in a detailed sampling system. As a result, the distribution of the turbulent exchange of mass and momentum could be determined. These quantities were analyzed in detail on the basis of some relevant theories, e.g. diffusion and mixing length theories. Attempts were made to correlate the physical quantities used in these theories with parameters related to the geometry and the flow conditions. Author (ESA)

N76-23241# Ohio Univ., Athens. Avionics Engineering Center.

INVESTIGATION OF EFFECTS OF GROUND-PLANE DEEP SNOW COVER ON IMAGE GLIDE SLOPE 1974-75 Final Report, Nov. 1974 - Aug. 1975

Richard H. McFarland Aug. 1975 37 p refs

(Contract DOT-FA75WA-3581)

(AD-A021690/3; EER-24-1; FAA-RD-75-210) Avail: NTIS HC \$4.50 CSCL 17/7

Results of the tenth consecutive year of data collection concerning snow effects on operation of image glide-slope systems are presented. Evidence continues to show that with snow on the reflecting ground plane, the far-field glide slope does not lower; rather it tends to rise approximately one-tenth of one degree elevation per one foot depth of snow. Further, the conventional near-field, 180 deg point monitor response does not correlate with far-field path performance when snow covers the ground. A two-frequency, capture-type far-field monitor was tested. At sites where deep snows exist, high snow banks accumulate alongside the runway, which affect the path angle and structure just beyond the runway threshold. Author

N76-23640 Oregon State Univ., Corvallis.
DIGITAL TECHNIQUES FOR CHANGE DETECTION FROM REMOTELY SENSED DATA (LANDSAT-IMAGERY) Ph.D. Thesis

Hassan Eghbali 1976 162 p

Avail: Univ. Microfilms Order No. 76-9846

Digital techniques for detecting changes between two LANDSAT images were developed. A data matrix containing 16x16 picture elements was used for this purpose. The LANDSAT-imagery data were corrected for sensor inconsistencies and varying sun illumination. The Kolmogorov-Smirnov test (K-S test) was performed between the two corrected data matrices. This test is based on the absolute value of the maximum difference $D(\max)$ between the two cumulative frequency distributions. The limiting distribution of $D(\max)$ is known; thus a statistical decision concerning changes can be evaluated for the region. The K-S test was applied to all bands of imagery (four through seven). The test was applied to four test sites. It successfully isolated regions of change in snow cover, forest cover (clear cut), and urban regions (Salem, Oregon). The test was found to be relatively independent of slight misregistration. A feature vector developed from the two dimensional Fourier and Hadamard transform was also shown to be sensitive for detecting changes. This vector shows promise for classifying large data blocks. Forest, urban, and snow regions were successfully classified. Dissert. Abstr.

N76-23641# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

SKYLAB-4 RADAR SCATTEROMETER MEASUREMENTS OVER LAND Final Report, 26 Mar. 1973 - 31 Dec. 1975

Richard K. Moore, Principal Investigator Feb. 1976 38 p refs EREP

(Contract NAS9-13331)

(E76-10307; NASA-CR-147569; RSL-TR-243-13) Avail: NTIS HC \$4.00 CSCL 17E

The author has identified the following significant results. Analysis of the SL4 S193 scatterometer observations shows that the winter measurements were reasonably consistent with summer measurements. The signals over land fall-off more rapidly in winter than in summer, probably because of the lack of vegetation return in winter; but the winter and summer results over land do not differ enough to cause changes in the general conclusions for the design of radars to be constructed for future space use. No consistent difference was found between snow-covered and snow-free terrain radar returns. The oceanic returns in winter were significantly different from those in summer, with a much less rapid fall-off with angle and a lower return at vertical. This is a true seasonal bias, for the winter seas tend to be much stormier than those in summer.

N76-23669# Old Dominion Univ. Research Foundation, Norfolk, Va.

APPLICATION OF SATELLITE DATA AND LARS'S DATA PROCESSING TECHNIQUES TO MAPPING VEGETATION OF THE DISMAL SWAMP M.S. Thesis - Old Dominion Univ.

Jeffrey Allan Messmore May 1976 75 p refs

(Grant NGL-47-003-067)

(NASA-CR-147951; PGSTR-AP76-31) Avail: NTIS HC \$4.50 CSCL 08B

The feasibility of using digital satellite imagery and automatic data processing techniques as a means of mapping swamp forest vegetation was considered, using multispectral scanner data acquired by the LANDSAT-1 satellite. The site for this investigation was the Dismal Swamp, a 210,000 acre swamp forest located south of Suffolk, Va. on the Virginia-North Carolina border. Two basic classification strategies were employed. The initial classification utilized unsupervised techniques which produced a map of the swamp indicating the distribution of thirteen forest spectral classes. These classes were later combined into three informational categories: Atlantic white cedar (*Chamaecyparis thyoides*), Loblolly pine (*Pinus taeda*), and deciduous forest. The subsequent classification employed supervised techniques which mapped Atlantic white cedar, Loblolly pine, deciduous forest, water and agriculture within the study site. A classification accuracy of 82.5% was produced by unsupervised techniques compared with 89% accuracy using supervised techniques. Author

N76-24667# Geological Survey, Reston, Va.
PROCESSING OF LANDSAT IMAGERY FOR DISSEMINATION PURPOSES Progress Report, 18 Aug. 1975 - 1 May 1976

Alden P. Colvocoresses, Principal Investigator and Hugh B. Loving 15 Apr. 1976 5 p ERTS

(NASA Order S-539-99)

(E76-10347; NASA-CR-147238) Avail: NTIS HC \$3.50 CSCL 05B

The author has identified the following significant results. The differentiation between bands 4 and 5 was achieved through enhancement. Depiction of dormant vegetation on the upper Chesapeake Bay image map in tones of green is an example of significant difference between bands 4 and 5 which can be achieved through proper enhancement.

N76-24685# Lockheed Electronics Co., Houston, Tex.
A NEW COMPUTER APPROACH TO MIXED FEATURE CLASSIFICATION FOR FORESTRY APPLICATION

E. P. Kan Apr. 1976 31 p refs

(Contract NAS9-12200)

(NASA-CR-147747; LEC-8061; JSC-11034) Avail: NTIS HC \$4.00 CSCL 02F

07 DATA PROCESSING AND DISTRIBUTION SYSTEMS

A computer approach for mapping mixed forest features (i.e., types, classes) from computer classification maps is discussed. Mixed features such as mixed softwood/hardwood stands are treated as admixtures of softwood and hardwood areas. Large-area mixed features are identified and small-area features neglected when the nominal size of a mixed feature can be specified. The computer program merges small isolated areas into surrounding areas by the iterative manipulation of the postprocessing algorithm that eliminates small connected sets. For a forestry application, computer-classified LANDSAT multispectral scanner data of the Sam Houston National Forest were used to demonstrate the proposed approach. The technique was successful in cleaning the salt-and-pepper appearance of multiclass classification maps and in mapping admixtures of softwood areas and hardwood areas. However, the computer-mapped mixed areas matched very poorly with the ground truth because of inadequate resolution and inappropriate definition of mixed features. Author

N76-24686*# Lockheed Electronics Co., Houston, Tex.
AN AD HOC MAP EVALUATION PROCEDURE
 E. P. Kan Apr. 1976 35 p refs
 (Contract NAS9-12200)
 (NASA-CR-147746; LEC-8278; JSC-11154) Avail: NTIS
 HC \$4.00 CSCL 08B

An ad hoc map evaluation procedure is proposed which is most suitable for evaluating low-resolution classification maps against high resolution ground truth maps, such as maps against interpreted aircraft photographs. Commonly practiced sampling and evaluation procedures are impracticable in this context because of difficulties in registration and in comparing the samples. This ad hoc procedure is designed to overcome these two major problems, and its practicability is discussed. Two widely accepted parameters are estimated by the new procedure; namely, the probability of correct classification and the proportion biases. Statistical qualifications are also provided. Author

N76-24760*# Old Dominion Univ., Norfolk, Va. Dept. of
 Physics and Geophysical Sciences.
**SOFTWARE FOR DIGITAL ACQUISITION SYSTEM AND
 APPLICATION TO ENVIRONMENTAL MONITORING**
 G. E. Copeland Nov. 1975 47 p refs
 (Grant NGL-47-003-067)
 (NASA-CR-147986; PGS-TR-AP-75-15) Avail: NTIS
 HC \$4.00 CSCL 13B

Criteria for selection of a minicomputer for use as a core resident acquisition system were developed for the ODU Mobile Air Pollution Laboratory. A comprehensive data acquisition program named MONARCH was instituted in a DEC-8/E-8K 12-bit computer. Up to 32 analog voltage inputs are scanned sequentially, converted to BCD, and then to actual numbers. As many as 16 external devices (valves or any other two-state device) are controlled independently. MONARCH is written as a foreground-background program, controlled by an external clock which interrupts once per minute. Transducer voltages are averaged over user specified time intervals and, upon completion of any desired time sequence, outputted are: day, hour, minute, second; state of external valves; average value of each analogue voltage (E Format); as well as standard deviations of these values. Output is compatible with any serially addressed media. Author

N76-24872# Naval Postgraduate School, Monterey, Calif.
**A COMPARISON OF SATELLITE IMAGES CAPABLE OF
 DETECTING OCEAN SURFACE FEATURES** M.S. Thesis
 Bruce William Platz, Jr. Sep. 1975 91 p refs
 (AD-A019380) Avail: NTIS CSCL 08/3

This study compares the capabilities of the images obtained from the archives for the satellites of National Oceanic and Atmospheric Administration (NOAA), Defense Meteorological Satellite Program (DMSP), and Earth Resources Technology Satellite (ERTS) systems for displaying information about oceanic currents and circulation features. GRA

N76-25008 Arizona Univ., Tucson.
**A METHOD FOR DETERMINING THE OPERATIONAL
 IMAGING PERFORMANCE OF ORBITAL EARTH RE-
 SOURCES SENSORS** Ph.D. Thesis
 Robert Alan Schowengerdt 1975 184 p
 Avail: Univ. Microfilms Order No. 76-11311

A technique, called Scale Matching Analysis (SMA), which is particularly applicable to measurements of the optical transfer function (OTF) of orbital earth resources sensors is presented. A comparison of SMA to an established technique for OTF measurements, Edge Gradient Analysis (EGA) is included along with a mathematical derivation of the noise in OTF, as calculated by each method. Sensitivity of the OTF calculated by SMA to errors in the analysis is evaluated by the introduction of artificially generated errors of known magnitude. The SMA is applied to two different scenes, one urban and the other desert, and the OTF's are compared. The noise in the OTF is measured for both EGA and SMA, and compared with mathematical predictions. Results are summarized and conclusions are drawn.

Dissert. Abstr.

N76-25619*# East Anglia Univ., Norwich (England). School
 of Environmental Sciences.

**DESIGN AND EVALUATION OF A COMPUTER BASED
 SYSTEM TO MONITOR AND GENERALISE, BY AREAS,
 DATA FROM ERTS PRECISION IMAGERY TAPES** Final
 Report, Jul. 1972 - Jul. 1974

Keith M. Clayton, Principal Investigator Sep. 1975 156 p
 refs Sponsored by NASA Original contains imagery. Original
 photography may be purchased from the EROS Data Center,
 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
 (E76-10374; NASA-CR-147967) Avail: NTIS HC \$6.75 CSCL
 05B

The author has identified the following significant results. An objective system for regionalization is described, using ERTS-1 (or LANDSAT) computer compatible tapes. A range of computer programs for analysis of these tapes was developed. Emphasis is on a level of generalization appropriate to a satellite system which repetitive global coverage. The main variables are land/water ratios and vegetation cover. The scale or texture of the pattern of change in these variables varies a good deal across the earth's surface, and it seems best if the unit of generalization adopted varies in sympathy with the surface being analyzed.

N76-25628*# Purdue Univ., Lafayette, Ind. Lab. for Applications
 of Remote Sensing.

**EXPERIMENTAL EXAMINATION OF SIMILARITY
 MEASURES AND PREPROCESSING METHODS USED FOR
 IMAGE REGISTRATION**

Martin Svedlow, C. D. McGillem, and P. E. Anuta 5 Jul. 1976
 123 p
 (Contract NAS9-14016)
 (NASA-CR-147664; LARS-IN-052175; T-1039/4) Avail: NTIS
 CSCL 05B

Image correlation algorithms developed to define improved approaches for updating the existing LARS system were compared. Particular emphasis was placed on the temporal registration of wheat land imagery in support of the LACIE (Large Area Crop Identification Experiment) program, however, the results have relevance for any registration problem. Author

N76-25630*# TRW Systems Group, Redondo Beach, Calif.
**LACIE PERFORMANCE PREDICTOR FINAL OPERATIONAL
 CAPABILITY PROGRAM DESCRIPTION, VOLUME 1**
 May 1976 339 p 3 Vol.
 (Contract NAS9-14547)
 (NASA-CR-147755; TRW-28234-6027-RU-00-Vol-1) Avail:
 NTIS HC \$10.00 CSCL 02C

The program EPHEMS computes the orbital parameters for up to two vehicles orbiting the earth for up to 549 days. The data represents a continuous swath about the earth, producing tables which can be used to determine when and if certain

land segments will be covered. The program GRID processes NASA's climatology tape to obtain the weather indices along with associated latitudes and longitudes. The program LUMP takes substrata historical data and sample segment ID, crop window, crop window error and statistical data, checks for valid input parameters and generates the segment ID file, crop window file and the substrata historical file. Finally, the System Error Executive (SEE) Program checks YES error and truth data, CAMS error data, and signature extension data for validity and missing elements. A message is printed for each error found. D.M.L.

N76-25631*# TRW Systems Group, Redondo Beach, Calif.
LACIE PERFORMANCE PREDICTOR FINAL OPERATIONAL CAPABILITY PROGRAM DESCRIPTION, VOLUME 2
 May 1976 394 p 3 Vol.
 (Contract NAS9-14547)
 (NASA-CR-147756; TRW-28234-6028-RU-00-Vol-2) Avail: NTIS HC \$10.75 CSCL 02C

Given the swath table files, the segment set for one country and cloud cover data, the SAGE program determines how many times and under what conditions each segment is accessed by satellites. The program writes a record for each segment on a data file which contains the pertinent acquisition data. The weather data file can also be generated from a NASA supplied tape. The Segment Acquisition Selector Program (SACS) selects data from the segment reference file based upon data input manually and from a crop window file. It writes the extracted data to a data acquisition file and prints two summary reports. The POUT program reads from associated LACIE files and produces printed reports. The major types of reports that can be produced are: (1) Substrate Reference Data Reports, (2) Population Mean, Standard Deviation and Histogram Reports, (3) Histograms of Monte Carlo Statistics Reports, and (4) Frequency of Sample Segment Acquisitions Reports. D.M.L.

N76-25632*# TRW Systems Group, Redondo Beach, Calif.
LACIE PERFORMANCE PREDICTOR FINAL OPERATIONAL CAPABILITY PROGRAM DESCRIPTION, VOLUME 3
 May 1976 535 p 3 Vol.
 (Contract NAS9-14547)
 (NASA-CR-147757; TRW-28234-6029-RU-00-Vol-3) Avail: NTIS HC \$13.00 CSCL 02C

The requirements and processing logic for the LACIE Error Model program (LEM) are described. This program is an integral part of the Large Area Crop Inventory Experiment (LACIE) system. LEM is that portion of the LPP (LACIE Performance Predictor) which simulates the sample segment classification, strata yield estimation, and production aggregation. LEM controls repetitive Monte Carlo trials based on input error distributions to obtain statistical estimates of the wheat area, yield, and production at different levels of aggregation. LEM interfaces with the rest of the LPP through a set of data files. Author

N76-25633*# TRW Systems Group, Redondo Beach, Calif.
LACIE PERFORMANCE PREDICTOR FOC USERS MANUAL
 1 May 1976 227 p
 (Contract NAS9-14547)
 (NASA-CR-147745; TRW-28234-6025-RU-00) Avail: NTIS HC \$8.00 CSCL 02C

The LACIE Performance Predictor (LPP) is a computer simulation of the LACIE process for predicting worldwide wheat production. The simulation provides for the introduction of various errors into the system and provides estimates based on these errors, thus allowing the user to determine the impact of selected error sources. The FOC LPP simulates the acquisition of the sample segment data by the LANDSAT Satellite (DAPTS), the classification of the agricultural area within the sample segment (CAMS), the estimation of the wheat yield (YES), and the production estimation and aggregation (CAS). These elements include data acquisition characteristics, environmental conditions, classification algorithms, the LACIE aggregation and data adjustment procedures. The operational structure for simulating

these elements consists of the following key programs: (1) LACIE Utility Maintenance Process, (2) System Error Executive, (3) Ephemeris Generator, (4) Access Generator, (5) Acquisition Selector, (6) LACIE Error Model (LEM), and (7) Post Processor. Author

N76-25634*# National Aeronautics and Space Administration.
 Goddard Space Flight Center, Greenbelt, Md.
A LANDSAT DIGITAL IMAGE RECTIFICATION SYSTEM
 Peter VanWie and Maurice Stein May 1976 13 p refs
 (NASA-TM-X-71115; X-931-76-101) Avail: NTIS HC \$3.50 CSCL 05B

DIRS is a digital image rectification system for the geometric correction of LANDSAT multispectral scanner digital image data. DIRS removes spatial distortions from the data and brings it into conformance with the Universal Transverse Mercator (UTM) map projection. Scene data in the form of landmarks are used to drive the geometric correction algorithms. Two dimensional least squares polynomial and spacecraft attitude modeling techniques for geometric mapping are provided. Entire scenes or selected quadrilaterals may be rectified. Resampling through nearest neighbor or cubic convolution at user designated intervals is available. The output products are in the form of digital tape in band interleaved, single band or CCT format in a rotated UTM projection. The system was designed and implemented on large scale IBM 360 computers. Author

N76-25635*# National Aeronautics and Space Administration.
 Goddard Space Flight Center, Greenbelt, Md.
THE PROPER WEIGHTING FUNCTION FOR RETRIEVING TEMPERATURES FROM SATELLITE MEASURED RADIANCES
 Albert Arking Mar. 1976 14 p refs
 (NASA-TM-X-71116; X-911-76-48) Avail: NTIS HC \$3.50 CSCL 05B

One class of methods for converting satellite measured radiances into atmospheric temperature profiles, involves a linearization of the radiative transfer equation: $\Delta r = \text{the sum of } (W_{\text{sub } i} (\Delta T_{\text{sub } i}) \text{ where } (i=1...s) \text{ and where } \Delta T_{\text{sub } i} \text{ is the deviation of the temperature in layer } i \text{ from that of a reference atmosphere, } \Delta R \text{ is the difference in the radiance at satellite altitude from the corresponding radiance for the reference atmosphere, and } W_{\text{sub } i} \text{ is the discrete (or vector) form of the T-weighting (i.e., temperature weighting) function } W(P), \text{ where } P \text{ is pressure. The top layer of the atmosphere corresponds to } i = 1, \text{ the bottom layer to } i = s - 1, \text{ and } i = s \text{ refers to the surface. Linearization in temperature (or some function of temperature) is at the heart of all linear or matrix methods. The weighting function that should be used is developed. Author}$

N76-25641# Singer Co., Sunnyvale, Calif. Simulation Products Div.
INFRARED IMAGE PREDICTION USING THE PROJECT 1183 OFF-LINE DIGITAL DATA BASE Final Report, 19 May - 10 Oct. 1975
 J. H. Jacobson and Steve Bryan Oct. 1975 103 p
 (Contract F33657-73-C-0692; AF Proj. 1183)
 (AD-A020117; UC-7254-02) Avail: NTIS CSCL 08/2

This report describes a field survey of the Las Vegas area to obtain infrared radiation data for features in the high resolution Defense Mapping Agency, Project 1183 off-line digital data base. The data have been analyzed and additional descriptors assigned to the digital data base to enable computer generation of infrared imagery that approximates real-world views. Computer-generated infrared imagery along with corresponding real-world imagery are included in this report to demonstrate the realism of the imagery predictions. The simulated images were generated on a real-time Digital Image Generator system. GRA

N76-26630*# Aeronutronic Ford Corp., Houston, Tex.
EARTH RESOURCES INTERACTIVE PROCESSING SYSTEM REQUIREMENTS
 C. W. Abbott, Principal Investigator Nov. 1975 404 p refs
 EREP

(Contract NAS9-1261)

(E76-10402; NASA-CR-147418; SISO-TR514; JSC-10152)

Avail: NTIS HC \$11.00 CSCL 05B

N76-26669* EROS Data Center, Sioux Falls, S. Dak.

DATA AVAILABILITY AND THE ROLE OF THE EARTH RESOURCES OBSERVATION SYSTEMS DATA CENTER

Allen H. Watkins / In NASA. Lyndon B. Johnson Space Center
NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975
p 372-378 (For availability see N76-26646 17-43)
CSCL 05B

With the launch of LANDSAT-1 in July 1972, and the follow-on launch of LANDSAT-2 in January of this year, routine availability of satellite imagery and electronic data of the earth's resources has become a reality. Federal data centers provide LANDSAT data to resource managers and the general public. These data centers have to date provided almost 500,000 frames of LANDSAT data at a cost of more than \$2,000,000. Data from the LANDSAT satellite program, along with data and information from the Skylab manned program, are available over any location to anyone for the cost of reproduction. Author

N76-26676# Oak Ridge National Lab., Tenn.

ANALYSIS APPLICATION OF LAND-USE DATA

A. H. Voelker 1975 19 p refs Presented at Proc. of Am. Soc. of Photogrammetry, Arizona, 26-30 Oct. 1975 Sponsored in part by ERDA and NSF
(CONF-751064-1) Avail: NTIS HC \$4.50

The ever broadening scope of planning requires improved techniques for gathering, manipulating and displaying spatial information. Fortunately, the combination of high altitude photography as a potential data source and computer based geographical information systems as a means of achieving efficient data manipulation offer the planner powerful analysis capability. The utility is demonstrated of land-use data extracted from high altitude photography in the development of a computerized land use model. A technique is explained for synthesizing mapped land-use data categorized in the Anderson Classification System with other spatial variables to create an abstract index of land use compatibility. The questions of resolution, accuracy, index validation, and index display are considered. Finally, some observations are made about the applicability of computer analysis using remote-sensor data. Author (ERA)

N76-26759# Panametrics, Inc., Waltham, Mass.

DESIGN, FABRICATION, AND FLIGHT OF A UV SPECTROPHOTOMETER ABOARD A WB57F HIGH ALTITUDE AIRCRAFT FOR THE CIAP FLIGHT SERIES- SUMMARY REPORT Final CIAP report, 1 Sep. 1972 - 30 Nov. 1975
Frederick A. Hanser, Bach Sellers, and Jean L. Hunerwadel Dec. 1975 83 p refs Sponsored in part by DOT
(Contract N00014-73-C-0316)

(AD-A019745; PANA-UVS-7) Avail: NTIS CSCL 14/2

An ultraviolet interference-filter spectrophotometer has been designed, fabricated, and installed on a WB57F high altitude (about 60 kft) aircraft as part of the Department of Transportation Climatic Impact Assessment Program. This instrument (designated the UVS, or UV Spectrophotometer) uses a UV diffuser, ten filters (sets) placed in a rotating wheel, and a high grade reggized photomultiplier to provide 12, second time-resolved UV spectra in the region between 200 and 400 nm. The objectives of the UVS are to provide SST altitude UV flux data (1), of aid in interpretation of other, simultaneous measurements made on the aircraft, and (2) for purposes of long term monitoring of geographical and seasonal variations. The operating history of the UVS is described and some graphical presentation of total ozone data are given. The UVS has proved very reliable, operating under the extreme environmental conditions of high altitude aircraft flight with no difficulty. Two years of CIAP deployment on the WB57F have demonstrated the long term stability of the UVS. The UVS has proven itself a valuable instrument for various atmospheric monitoring programs. GRA

N76-27637*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

LANDSAT US STANDARD CATALOG, 1-31 MARCH 1975
31 Mar. 1976 114 p

(NASA-TM-X-74141; GSFC/LU-76/003;

NTISUB/B/138-76/003) Avail: NTIS HC \$5.00 CSCL 05B

The U.S. Standard Catalog lists U.S. imagery acquired by LANDSAT 1 and LANDSAT 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N76-27638*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

LANDSAT NON-US STANDARD CATALOG, 1-31 MARCH 1976

31 Mar. 1976 117 p

(NASA-TM-X-74140; GSFC/LN-76/003;

NTISUB/B/139-76/003) Avail: NTIS HC \$5.50 CSCL 05B

The Non-U.S. Standard Catalog lists Non-U.S. imagery acquired by LANDSAT 1 and LANDSAT 2 which have been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N76-27639*# Texas A&M Univ., College Station. Dept. of Mathematics.

APPLICATIONS OF FEATURE SELECTION Final Report, 1 Jun. 1975 - 31 May 1976

L. F. Guseman, Jr. 31 May 1976 154 p refs

(Contract NAS9-14689)

(NASA-CR-147790) Avail: NTIS HC \$6.75 CSCL 05B

The use of satellite-acquired (LANDSAT) multispectral scanner (MSS) data to conduct an inventory of some crop of economic interest such as wheat over a large geographical area is considered in relation to the development of accurate and efficient algorithms for data classification. The dimension of the measurement space and the computational load for a classification algorithm is increased by the use of multitemporal measurements. Feature selection/combination techniques used to reduce the dimensionality of the problem are described. Author

N76-27642*# Rice Univ., Houston, Tex. Inst. for Computer Sciences and Applications.

PHASE 4 OF THE RICE UNIVERSITY EARTH RESOURCES DATA ANALYSIS PROGRAM Final Report, Jun. 1975
Jun. 1976

Jun. 1976 16 p refs

(Contract NAS9-12776)

(NASA-CR-147826; ICSCA-TR-2/5-025-FPIV) Avail: NTIS HC \$3.50 CSCL 05B

Projects were completed in the development of various pattern recognition algorithms and the development of some general purpose algorithms useful in remote sensing calculations. Author

N76-27644*# Agnew, Tech-Tran, Inc., Woodland Hills, Calif.

SPACE REMOTE SENSING OF THE EARTH LANDSCAPES

A. A. Grigoryev Washington NASA Jul. 1976 282 p refs
Transl. into ENGLISH of the book "Kosmicheskaya Indikatsiya Landshaftov Zemli" Leningrad State University, Leningrad, 1975
165 p

(Contract NASw-2789)

(NASA-TT-F-16924) Avail: NTIS HC \$9.25 CSCL 08B

The development of space photography has opened new and wide possibilities for the investigation of landscapes which are important for solving reverse meteorological problems and for the development of space geography. A textbook is presented which is based both on original investigations of the author and the experience of Soviet and foreign researchers, and which considers for the first time in a systematized manner the

possibilities of the remote space sensing of various types of the earth's underlying surfaces. Various types of space imageries from different regions of the world (i.e., in the United States) are analyzed. The text is designed for people studying questions of remote sensing of the environment and may be used by space ecology specialists, meteorologists, geophysicists, geographers, and cartographers. Photographs and illustrations are shown.

Author

N76-27649*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.

DIGITIZING ZONE MAPS, USING MODIFIED LARSYS PROGRAM

L. Giddings and S. Boston May 1976 175 p refs
(Contract NAS9-12200)

(NASA-CR-147803; LEC-7498; JSC-10757) Avail: NTIS HC \$6.75 CSCL 08B

A method for digitizing zone maps is presented, starting with colored images and producing a final one-channel digitized tape. This method automates the work previously done interactively on the Image-100 and Data Analysis System computers of the Johnson Space Center (JSC) Earth Observations Division (EOD). A color-coded map was digitized through color filters on a scanner to form a digital tape in LARSYS-2 or JSC Universal format. The taped image was classified by the EOD LARSYS program on the basis of training fields included in the image. Numerical values were assigned to all pixels in a given class, and the resulting coded zone map was written on a LARSYS or Universal tape. A unique spatial filter option permitted zones to be made homogeneous and edges of zones to be abrupt transitions from one zone to the next. A zoom option allowed the output image to have arbitrary dimensions in terms of number of lines and number of samples on a line. Printouts of the computer program are given and the images that were digitized are shown.

Author

N76-27650*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.

AN EIGHT-NEIGHBOR FILTER FOR LARSYS

S. Boston and L. Giddings May 1976 46 p refs

(Contract NAS9-12200)

(NASA-CR-147802; LEC-7619; JSC-10795) Avail: NTIS HC \$4.00 CSCL 08B

An eight-neighbor filter was developed for the LARSYS program. It is used in cleaning zones and sharpening boundaries during the digitization of hand-painted zone maps, in making computer-based vegetation zones more homogeneous, and in classification of natural images, such as LANDSAT or other multispectral imagery.

Author

N76-27653*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

QUANTIZATION AND SYMMETRY IN PERIODIC COVERAGE PATTERNS WITH APPLICATIONS TO EARTH OBSERVATION

Joseph C. King Dec. 1975 11 p refs Presented at the AAS/AIAA Astrodynamics Specialist Conf., Nassau, Bahamas, 28-30 Jul. 1975

(NASA-TM-X-71155) Avail: NTIS HC \$3.50 CSCL 08B

Analytical approaches based on an idealized physical model and concepts from number theory show that in periodic coverage patterns, uniquely defined by their revolution numbers R (orbital) and N (rotational), the subnodal points are earth-fixed, and they divide the equator into R equal segments of length s . The ascending subsatellite trace crosses each point once (only) each period. The descending subnodal points coincide with the ascending points if the integers N and R have like parity, and bisect the intervals between them if opposite. The interval between consecutive unidirectional crossings is Ns . Symmetries extend the equatorial results to all parallels of latitude. Complete periodic patterns of traces exhibit an overall symmetry, with

trace intersections confined to discrete coordinate values which are quantized in longitude (basic s -unit) and symmetric in latitude.

Author

N76-27657# Texas Highway Dept., Austin. Div. of Automation.

NUMERICAL GROUND IMAGE SYSTEM

William L. Crawford and Roy R. Guess Oct. 1974 152 p
Prepared in cooperation with Federal Highway Admin., Washington, D. C.

(PB-249512/5; THD-1-19-71-186-2F) Avail: NTIS HC \$6.75 CSCL 08B

This report (1) explains computer methods for representing a terrain surface using a numerical surface and (2) provides user instructions for data retrieval of cross-sections computed from this surface model. The appendix contains an example problem, a detailed explanation of the algorithms used, and the program documentation for the Numerical Ground Image system.

GRA

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INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A76-29050 * Remote profiling of lake ice using an S-band short-pulse radar aboard an all-terrain vehicle. D. W. Cooper, R. A. Mueller, and R. J. Schertler (NASA, Lewis Research Center, Cleveland, Ohio). *Radio Science*, vol. 11, Apr. 1976, p. 375-381. 12 refs.

A short-pulse (one nanosecond) S-band radar system was developed to supplement the information obtained with the aid of the SLAR system of the Great Lakes ice information system. It is the objective of the ice information system to aid in extending the winter navigation season. The SLAR imagery cannot be interpreted directly to obtain information concerning the thickness of the ice. This information is to be provided by a remote ice measuring system utilizing nanosecond radar pulses. A description is given of investigations in which such a system was installed on a C-47 aircraft. In other studies reported an S-band short-pulse radar was mounted on an all-terrain vehicle. G.R.

A76-31427 # Fundamentals of remote sensing (Grundlagen der Fernerkundung). H.-J. Bolle (München, Universität, Munich, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 1-9. 6 refs. In German.

In a brief historical review, the origin and development of the remote sensing technique to its present level of sophistication is traced to its importance for purposes of astrophysics. The elements of remote sensing are outlined, and the differences between remote sensing and such techniques as indirect sounding are pointed out. The adaptation of remote sensing to earth resource surveys is discussed. V.P.

A76-31438 # First experience with a digital multispectral scanner (Erste Erfahrungen mit einem digitalen Multispektral-Scanner). K. Völger (Umwelt-Data GmbH, Offenbach, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 167-178. In German.

Some aspects of the Bendix M2S digital multispectral scanner which have found little attention in the literature are discussed in view of the difficulties encountered by admittedly insufficiently qualified personnel in the operation of this complex instrument. Some flight-planning criteria are examined. In-flight operation of the instrument was found to meet the manufacturer's specifications. V.P.

A76-31441 # Some radar fundamentals in inexpensive side looking airborne radar and measurement of wind speed over the ocean by radar scatterometers with preliminary results from SKYLAB. R. K. Moore (Kansas, University, Lawrence, Kan.). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 223-245.

The use of imaging radar over land is discussed, and the need for multispectral radar and for optimum choices of single frequencies, angles of incidence, and polarizations is demonstrated. Trade-offs

between gray tone rendition on radar image and spatial resolution are indicated. A side looking airborne radar, (at a cost below \$50,000) on the basis of a radar designed for ships is described which uses a unique scan converter and TV display system, rather than the more conventional strip film recorder. The response of the theoretically and experimentally (aircraft measurements) predicted radar scattering from the oceans to windspeed variations is verified, using data from the Skylab radiometer-scatterometer experiment. V.P.

A76-31444 # Microwave sensing of the sea state (Fernerkundung des Seegangs mit Mikrowellen). W. Alpers (Hamburg, Universität, Hamburg, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 281-289. 13 refs. In German.

The application of two active microwave systems - the synthetic aperture side-looking radar and the two-frequency scatterometer - to the remote sensing of ocean waves is discussed. A brief description of the application characteristics of other microwave systems, such as the nanosecond radar altimeter, the two-frequency radar interferometer, and the microwave radiometer is given also. The economic usefulness of sea state forecasts is pointed out. V.P.

A76-31445 # Active and passive microwave systems in the remote sensing of the earth and atmosphere (Aktive und passive Mikrowellensysteme als Hilfsmittel bei der Fernerkundung der Erde und der Atmosphäre). H. Schwillé and E. Velten (Dornier-System GmbH, Friedrichshafen, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 291-309. 8 refs. In German. Gesellschaft für Weltraumforschung Contract No. RV21-V61/74-KA-50.

The characteristic parameters of microwave radiometers and side-looking radars are examined, and some representative radiometer and radar systems are discussed. Particular attention is given to such active microwave systems as the altimeter and scatterometer that form the basis of imaging radar systems. Possible applications of spaceborne microwave systems are examined. V.P.

A76-31455 # Evaluation of infrared thermal scans (Auswertung von Infrarot-Wärmeaufnahmen). F.-H. Hirt (Siedlungsverband Ruhrkohlenbezirk, Essen, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 437-452. 5 refs. In German.

The paper describes remote sensor observations of water resources (the Rhine river) and the German countryside performed by means of an airborne thermal infrared scanner. The accuracy with which the infrared scanner determines water surface temperature profiles is studied as a function of meteorological parameters: atmospheric temperature and wind behavior. A digicolor evaluation is performed on thermal images of the Rhine and an attempt is made to determine the heat balance characteristics of the river between Krefeld and Wesel. Airborne thermal infrared scans were made of the German countryside - industrial and rural areas - on a clear night in 1973 from April 25 to 26. Particular attention was paid to the cooling of the earth surface and to the effect of free surfaces on the temperature of populated areas. B.J.

A76-31456 # Thermal loads in the case of bodies of running water and their study by means of infrared sensors (Wärmebelastung von Fließgewässern und ihre Erfassung durch Infrarot-Sensoren). V. Kroesch (Bundesforschungsanstalt für Landeskunde und Raumordnung, Bad Godesberg, West Germany). In: Symposium on Earth

Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 453-457. In German.

The reported investigation was concerned with conditions in an area in West Germany including 55 km of the Saar river. The area contains four steel mills, four power plants, a coking plant, and a sugar refinery. Aircraft-borne sensors were used to identify the location of all warm-water inflows in the river. Mixing phenomena and propagation characteristics were also studied. The surface temperatures of the Saar are shown in a graph. An interpretation of the observed temperature characteristics is given and suitable approaches for a surveillance of bodies of water are discussed. G.R.

A76-31462 # Earth science Aircraft Measurement Program /FMP/ - Scientific-technical conception and project status (Erdwissenschaftliches Flugzeug-Messprogramm /FMP/ - Wissenschaftlich-technische Konzeption und Projektstatus). M. Wahl (Gesellschaft für Weltraumforschung mbH, Porz-Wahn, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, Apr. 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 519-527. 6 refs. In German.

The paper gives an overview of planned technical and organizational measures for realizing an airborne measurement program whose goal is to evaluate the requirements for a qualified participation of the Federal Republic of Germany in future international projects on scientific and economic exploration of earth resources. Planned activities in four test areas are outlined: study of technological aspects of remote sensing, in particular, data processing and image processing; study of the applicability of remote sensing to oceanography and sea pollution, regional planning and environmental pollution; land and forest husbandry; and ecology. P.T.H.

A76-31467 # Requirements placed on operational remote sensing satellites and the state of the art of sensor technology (Anforderungen an operationelle Satelliten zur Fernerkundung der Erde und Stand der Sensortechnik). E. Velten and W. Gilg (Dornier-System GmbH, Friedrichshafen, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 591-607. 8 refs. In German. Gesellschaft für Weltraumforschung Contract No. RV21-V64/74-KA-50.

The potential and the limitations of operational remote sensing satellites are discussed. The requirements placed on operational satellites by users in the fields of hydrology and agriculture are reviewed, and the system of sensors capable of meeting these requirements is identified. The individual sensors are described, and the current status and developmental trends of sensor technology are reviewed. V.P.

A76-31473 # Multispectral photography demonstrated by several examples of military geography (Multispektralphotographie an einigen militärländeskundlichen Beispielen). E. Blanck (Amt für Militärkunde, Munich, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 677-691. 15 refs. In German.

The question whether aerial multispectral photography is capable of improving or supplementing military timber surveys is studied, using established data acquisition and processing methods. Results obtained for a mountainous and a coastal region indicate that under favorable conditions, multispectral photographs obtained from orbital altitudes may be regarded as a useful alternative to conventional small-scale aerial photographs for preliminary terrain characterization purposes. V.P.

A76-33024 # Interpretation of aerial photographs (Deshifirovanie aerosnimkov). L. A. Bogomolov. Moscow, Izdatel'stvo Nedra, 1976. 145 p. 47 refs. In Russian.

The physiological, photographic, and geographic fundamentals of aerial-photo interpretation are outlined, and modern interpretation methods are examined. The problems covered include: the characteristics of problems involved in sophisticated interpretation methods; research into the optical properties of landscapes; automation of the interpretation process; and methods of obtaining the maximum possible information for aerial photographs. Attention is given to the conversion and statistical processing of aerial photographs and to methods of obtaining additional information from non-photographic and satellite imagery. V.P.

A76-33176 Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volumes 1 & 2. Symposium sponsored by the International Society for Photogrammetry, Canadian Forestry Service, Alberta Environment, and University of Alberta. Ottawa, Canadian Institute of Surveying, 1975. Vol. 1, 474 p.; vol. 2, 419 p. Price of two volumes, \$15. In English and French.

Remote sensing (aerial photography, Landsat) is applied to the following areas: land use, resource inventories, water and wetlands monitoring, environmental monitoring, vegetation damage, and geology. Attention is paid to interpretation and analysis of remote sensor images. Landsat multispectral scanner observations are applied to mapping urban land use in the United States, to soil mapping in California and to forest classification at the regional level. Aerial photography as applied to terrain mapping, to the assessment of volume characteristics of tropical rain forests and to forest monitoring is considered. B.J.

A76-33189 * # Use of multiple-stage remote sensing techniques to develop forest stocking equations. H. R. Bisson, W. O. Rasmussen, and P. F. Ffolliott (Arizona, University, Tucson, Ariz.). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 147-155. 6 refs. Research supported by the University of Arizona and NASA.

Portions of a forest supporting density levels that affect natural resource yields must be quantified to estimate the operational feasibility of a proposed management system. Estimates of average parameters do not necessarily provide complete knowledge, particularly with frequently skewed forest parameters. Instead, another statistic, the portion of a forest supporting minimum density levels would be useful to set realistic limits to the implementation of management systems and to establish priorities for operational programs. Such a statistic can be obtained from solutions of forest stocking equations generated by applications of multiple-stage remote sensing techniques. (Author)

A76-33214 # Canadian remote sensing - Regional centres. V. Zsilinszky (Ministry of Natural Resources, Ontario Centre for Remote Sensing, Toronto, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 515-525.

The furthering of applied remote sensing in Canada is based on the concept that the federal government is responsible for a continuing space and high-altitude airborne data acquisition and dissemination program, while the provincial governments are to contribute by putting that data into full use on a regional basis. In view of this concept, brief background information is given on the development and status of the national program, and a status review is prepared on the provincial activities. The uneven provincial commitments and contributions to the application of remote sensing are examined and hints for improvement are offered. (Author)

A76-33224 # The principles and partial realization of a system of automatic thematic cartography (Cartographie thématique automatique - Principes et réalisation partielle d'un système). S. Braconne, A. Fontanel, M. Guy, and C. Lallemand (Institut Français du Pétrole, des Carburants et Lubrifiants, Rueil-Malmaison, Hauts-de-Seine, France). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 631-646. 18 refs. In French.

A system of interpretation in automatic thematic cartography consists of three functional parts. In the 'texturing' step, the greatest number of categories distinguishable in the image on the basis of their spatial and spectral characteristics is determined. Several texturing procedures are described, including a discrimination analysis using a 'supervised' method, an analysis in terms of principal components, and an adaptive ('nonsupervised') analysis. Position relationships between texture elements, and the significance of textural elements in terms of the problem under consideration are analyzed in the 'structuring' step. In the final step, 'modeling', the correspondence between the previously determined structures and properties of the subject of interest is analyzed. This step has been accomplished by application of a Fourier transform or a topological algorithm in certain simple cases. Several examples of the application of these steps in extracting information from ERTS data and aerial photographs are discussed. C.K.D.

A76-33226 # Statistical evaluation of multispectral scanner images. E. Triendl, G. Kritikos, M. Schroeder (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Forschungszentrum, Oberpfaffenhofen, West Germany), and B. Sahai. In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 667-681.

An important method for classification of multispectral scanner images is the ratio-mapping method: The classification of objects whose signatures vary in time, climate and season proves to be a difficult task. To overcome some of the difficulties, the ratio of grey levels of the same picture element in two different spectral bands is determined. A frequency distribution of these ratios as well as the variance sigma is obtained. Once sigma is determined, the feature extraction task is very much simplified. The accuracy of the method is further improved by dividing the picture in segments and applying the above procedure to each segment. Making use of these procedures, a classification map of the Bavarian landscape has been attempted. (Author)

A76-33234 # Effect of flying height on the color of targets imaged on color infrared film. J. H. Hansen (Missouri, University, Columbia, Mo.). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 2. Ottawa, Canadian Institute of Surveying, 1975, p. 813-828. 8 refs. Research supported by the University of Missouri.

Color 'shifts' in transparencies developed from Kodak Aerochrome infrared film type 2443 (identical batch number) exposed at different flight altitudes, with manufacturer's exposure compensation and filtering recommendations adhered to, are analyzed statistically. Red, green, and white targets were photographed on two flight dates from 460 m, 1800 m, and 4600 m, and images were scanned spectrophotometrically. Shifts toward blue-green with increasing height are reported. Color shifts associated with target reflectance were enhanced by film exposure differences. Color similarity between imaged targets photographed at the same altitude but on different dates is close (assuming like atmospheric conditions, time of day, and exposure conditions). Results are reported for each target color separately. R.D.V.

A76-33814 Data collection platforms /DCP's/. K. L. Farber (American Electronic Laboratories, Inc., Lansdale, Pa.). In: Annual Symposium on Frequency Control, 29th, Atlantic City, N.J., May 28-30, 1975, Proceedings. Washington, D.C., Electronic Industries Association, 1975, p. 285-293. 5 refs.

The Tropical Wind, Energy Conversion, and Reference Level Experiment (TWERLE) is considered. TWERLE is to obtain significant data on the upper tropical atmosphere through the satellite tracking of constant-level balloons on a global scale. Buoy Transmit Terminals (BTTs) are employed on drifting ocean buoys making oceanic and meteorological measurements. The Random Access Measurement System (RAMS) in connection with the NIMBUS-F satellite provides the capability for data collection and location determination for a large number of platform configurations. A NIMBUS-F RAMS description is given and BTT requirements are discussed along with aspects of BTT design. G.R.

A76-35015 * # Remote sensing - Potential interference problems and solutions. J. Freibaum (NASA, Office of Applications, Washington, D.C.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 173-181.

The paper discusses general radio frequency interference considerations associated with frequency and bandwidth allocations for satellite-borne microwave remote sensors. The interplay of frequency allocation and radio frequency interference is discussed for the cases of passive microwave sensors and active microwave sensors, the latter case involving shared band interference and out-of-band interference. B.J.

A76-35025 * # The correlation interferometer - A new instrument specifically designed for remote measurement of atmospheric trace species. R. Dick, A. R. Barringer, G. M. Levy, H. Zwick (Barringer Research, Ltd., Toronto, Canada), H. W. Goldstein, R. N. Grenda, M. H. Bortner (General Electric Co., Philadelphia, Pa.), and P. J. LeBel (NASA, Langley Research Center, Hampton, Va.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 293-304. 7 refs.

A76-35034 # Collection and processing of remote sensing data related to wildlife conservation in natural environments. J. E. Nichol (Aston, University, Birmingham, England). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 369-372.

The paper outlines the collection, processing, and evaluation of remote sensing data related to wildlife habitats in a natural environment in Scotland by both manual and machine-aided methods. The film types used are black-and-white panchromatic prints and true color transparencies, both at a scale of 1:10,000. Both the habitat type and the intrahabitat features are given a value based on questionnaires sent to a group of eminent ecologists, and a printout of the total value for each square is obtained. To obtain a more objective measure of terrain diversity both within and between habitats, a scanning microdensitometer is used with 38 randomly selected frames of the true color transparencies in order to measure variations in photographic density. Processing of the scanning graphs involve consideration of the total number of intersections of the graph with class boundaries fixed according to the average range of all the graphs and of each individual graph. Capabilities and shortcomings of the performed survey are pointed out. S.D.

A76-35037 # Testing low cost interpretation systems for updating land use inventories. E. E. Hardy and L. E. Hunt (Cornell University, Ithaca, N.Y.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 393-400. 7 refs.

Results are presented for a research project directed toward identifying a number of possible low-cost approaches for acquiring inventory data and toward testing the alternatives using accuracy and efficiency as major components in a suitability rating of the various systems examined. The techniques tested include use of the zoom stereoscope, use of orthophoto base maps, use of high-altitude imagery, color photography, and regular black-and-white photography. Microfiche readers are also adapted to this work. The personnel on the project were all experienced photo interpreters. Of the techniques tested, based on ease of interpretation, the first choice would be to use the microfiche readers with small-scale color transparencies. The second choice would be to use the small light table with high magnification to interpret small-scale color imagery. The third choice would be to use pocket stereoscopes and large-scale black-and-white photography. S.D.

A76-35044 # Past and future remote sensing at Newcastle University, Australia. C. D. Ellyett (NOAA, Environmental Data Service, Colorado, University, Boulder, Colo.), P. F. Goldsbrough, E. C. McLauchlan, and D. Pratt. In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 471-476.

A Daedalus airborne infrared linescan unit, operating principally in the 8-14 micron region, has been used by the University of Newcastle, N.S.W. Australia, for the past five years. Apart from conventional imagery, data are now being converted to digital format and computer processed to give thermal contours. These can be superposed on aerial photographs. Most work to date has been associated with water quality. A project is due to start in 1976 integrating airborne data with meteorological test site results to provide estimates of evapotranspiration over a complete annual cycle. The work will also serve as a basis to determine whether the data from the NASA Heat Capacity Mapping Satellite, due to be launched in late 1977, can be used to measure evapotranspiration over large areas. (Author)

A76-35045 # A completely airborne calibration of aerial infrared water-temperature measurements. J. R. Schott (Calspan Corp., Buffalo, N.Y.) and R. H. Tourin (New York State Energy Research and Development Authority, New York, N.Y.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 477-484. 5 refs.

A completely airborne method to calibrate aerial infrared mapping of water temperature was developed. This technique utilizes infrared radiometer data collected on a series of passes at different altitudes over a target area to calibrate the radiometer for absolute temperature at zero altitude, without the need for ground-based measurements. The radiometer data are, in turn, used to calibrate an aerial infrared thermal mapper, which scans the water surface viewed in a series of line scans over a 120 deg view angle perpendicular to the direction of airplane travel. The airborne calibration method was applied to 75 infrared images of 31 power plant discharges in New York State. Surface temperature measurements made simultaneously with the overflights were subsequently compared to the results of the aerial infrared mapping. The surface and aerial measurements agreed well, usually within 1 F. (Author)

A76-35046 # Use of remote sensing for water resource management in Michigan. R. J. Christensen (Michigan Department of

Natural Resources, Lansing, Mich.) and C. T. Wezernak (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 485-494.

The operational use of remote sensing by the Michigan Water Resources Commission is discussed. The applications considered included power plant discharges and industrial discharges. Applications are examined in terms of using spectral bands in the thermal IR, visible, and ultraviolet. The results indicate that remote sensing can serve as an important addition to techniques available to a regulatory agency for environmental monitoring. (Author)

A76-35051 # Development of remote sensing techniques in Italy. R. Cassinis (Milano, Università; CNR, Istituto per la Geofisica della Litosfera, Milan, Italy). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 533-543.

A76-35052 # Remote sensing in the Netherlands. D. Eckhart and P. Geerders (Netherlands Interdepartmental Working Community for the Application of Remote Sensing Techniques, Delft, Netherlands). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. (A76-35001 16-43) Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 545-548.

A76-35053 # On some remote sensing activities in Spain - A computer approach. R. Aguilar, J. L. Picón (Madrid, Universidad Autónoma, Madrid, Spain), and R. Nuñez de las Cuevas (Instituto Geográfico y Catastral, Madrid, Spain). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 549-554.

A76-35054 # The Swedish remote sensing program. S. Zenker (Swedish Space Corp., Solna, Sweden). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 555-562. 51 refs.

A76-35055 # Applications of remote sensing in Switzerland. H. Haefner, K. Itten (Zürich, Universität, Zurich, Switzerland), E. Schanda, M. Winiger (Bern, Universität, Berne, Switzerland), and K. Seidel (Eidgenössische Technische Hochschule, Zurich, Switzerland). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 563-570. 33 refs.

A76-35062 # Remote sensor for measurement of a tidal current velocity. S. Tsutsumi, Y. Itakura (Kyoto Institute of Technology, Matsugasaki, Japan), and T. Takagi (Fukuyama University, Fukuyama, Hiroshima, Japan). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 637-646.

An amplitude-modulated reticle finds some applications to remote sensing of image-velocity. This type of sensor with a PbS detector was built to test the feasibility of measuring the temporal variation of a rapid tidal current velocity in the Inland Sea.

Feasibility has been demonstrated and it should be possible to develop a system that could measure the instantaneous tidal current velocity. A modified system, which can make a simultaneous measurement of the magnitude and direction of the tidal current velocity, is proposed by the authors. (Author)

A76-35128 # The use of Landsat DCS in reservoir management and operation. S. Cooper and J. L. Horowitz (U.S. Army, Corps of Engineers, Waltham, Mass.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1347-1351.

Investigations are conducted by the New England Division, Corps of Engineers (NED) concerning the usefulness of orbiting satellites such as Landsat in the operation of NED water resources systems used to control floods. The data collection aspects of these studies are discussed. Attention is given to the Landsat data collection system and the NED ground receiving station. It is pointed out that based on its Landsat experience, NED has endorsed the institution of a satellite data collection system on a Corps-wide basis or a nationwide system with other Federal and State agencies. G.R.

A76-35135 * # A report on the use of thermal scanner data in an operational program for monitoring apparent rooftop temperatures. J. Bjorklund (Central Telephone and Utilities Corp., Sioux Falls, S. Dak.), F. A. Schmer, and R. E. Isakson (South Dakota State University, Brookings, S. Dak.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1437-1446. Grant No. NGL-42-003-007.

CENGAS, a division of Central Telephone and Utilities Corporation in cooperation with the Remote Sensing Institute, South Dakota State University, is using airborne thermal scanner data to monitor relative rooftop temperatures. Four Nebraska communities and one South Dakota community were surveyed by the Remote Sensing Institute for CENGAS. Thermal scanner data were converted to a film format and the resultant imagery has been successfully employed by CENGAS. The program places emphasis on heat losses resulting from inadequate home insulation, offers CENGAS customers the opportunity to observe a thermogram of their rooftop, and assists homeowners in evaluating insulation needs. (Author)

A76-38107 * # Ice reconnaissance by satellite. P. Gloersen (NASA, Goddard Space Flight Center, Greenbelt, Md.) and W. M. Strome (Canada Centre for Remote Sensing, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 93, 94.

The paper describes the significant milestones in the use of satellites for snow and ice monitoring. The feasibility of such monitoring was demonstrated by the Tiros 2 satellite in 1961. Nimbus 1 showed that breaks in the sea ice can be easily monitored during continuous nighttime conditions; Nimbus 3 showed the practicality of delineating regions of active melting of ice and snow in temperate areas. Landsat data have been found to be particularly useful for monitoring and studying glaciers and their attendant surface features. Ice concentration can be determined with reasonable accuracy from a sequence of electronically scanned microwave radiometer images made aboard Nimbus 5. In the future we can expect improved sensors and spacecraft systems with longer operating lives. P.T.H.

A76-38124 # An evaluation of optical techniques for remote sensing of oil spills in the Beaufort Sea. W. R. McNeil (W. R. McNeil and Associates, Inc., Toronto, Canada) and P. A. Lapp (P. A. Lapp, Ltd., Toronto, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 297-308. 15 refs.

A76-38135 # The integration of different aerial remote sensors and map data in making engineering and resource studies. J. D. Mollard (J. D. Mollard and Associates, Ltd., Regina, Saskatchewan, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 413-419.

Problems in the integration of different types of remote sensing activities and data are discussed. Remote sensing projects (1806 studies from 1955 to 1975) are broken down in terms of user purposes, types of distinct aerial remote sensors (in addition to Landsat-1 imagery) are listed, and attempts at integrated interpretation of remotely-sensed data are considered. A typical sequence of integrated aerial remote sensors on a northern transportation route project is constructed, in eleven steps. Situations where interpretation of Landsat-1 imagery was found useful are listed, and ten selected examples of use of satellite imagery (not reproduced in the paper) are listed. The importance of practical expertise, and gestalt-type pattern recognition, in interpretation of remotely-sensed data is emphasized. R.D.V.

N76-22896# Oak Ridge National Lab., Tenn.
MEASUREMENT OF MAN'S EXPOSURE TO EXTERNAL RADIATION

K. Becker 1975 25 p refs Presented at the 2d Latin-Am. Conf. on Med. Phys. and Radiation Protect., Belo Horizonte, Brazil (CONF-750738-1) Avail: NTIS HC \$4.25

After outlining briefly the rationale for personnel radiation monitoring with integrating detectors, a review is presented of some developments which have taken place in personnel and environmental dosimetry during the past 3.5 years. The results of a pilot field experiment concerning the stability of film and thermoluminescent dosimeters (TLDs) in four Latin-American countries are summarized. It shows that film dosimeters should be used only with caution, and in locations with a moderate climate. A survey is being conducted on the current status and trends in personnel monitoring, involving detailed questioning of over 150 laboratories in about forty countries to obtain information on the type of service and detectors, evaluation and recordkeeping, additional applications, problem and development areas, intercomparisons, practical experiences with different systems, administrative and legal aspects, etc. Author (NSA)

N76-23084* Smithsonian Institution, Washington, D.C. National Air and Space Museum.

EARTH OBSERVATIONS AND PHOTOGRAPHY EXPERIMENT MA-136

Farouk El-Baz and D. A. Mitchell /n NASA. Lyndon B. Johnson Space Center Apollo-Soyuz Test Project Feb. 1976 64 p refs
CSCL 08E

The primary objectives of the earth observations and photography experiment of the Apollo Soyuz Test Project were to photograph various terrestrial structures and to use the capabilities of man as a trained observer in visually studying earth features and phenomena. Man's special capabilities include the sensitivity of the eye to subtle color variations and the speed with which the eye/brain system can interpret what is seen and select targets for photography. Real time astronaut observations constitute a useful complement to orbital photographs and greatly aid in their interpretation. Targets for mapping and hand held photography were selected on the basis of their value to specialists in the earth sciences including geology, oceanography, desert study, hydrology, meteorology, and environmental science. Author

N76-24666*# TRW Systems Group, Redondo Beach, Calif.
FUNCTIONAL DESIGN FOR OPERATIONAL EARTH RESOURCES GROUND DATA PROCESSING Final Report, 6 Dec. 1971 - 6 Sep. 1972

C.J. Baldwin, Principal Investigator, L.H. Bradford, D.E. Hutson, and D.R. Jogle 15 Sep. 1972 121 p EREP

08 INSTRUMENTATION AND SENSORS

(Contract NAS9-12336)

(E76-10346; NASA-CR-147656) Avail: NTIS HC \$5.50 CSCL 05B

The author has identified the following significant results. Study emphasis was on developing a unified concept for the required ground system, capable of handling data from all viable acquisition platforms and sensor groupings envisaged as supporting operational earth survey programs. The platforms considered include both manned and unmanned spacecraft in near earth orbit, and continued use of low and high altitude aircraft. The sensor systems include both imaging and nonimaging devices, operated both passively and actively, from the ultraviolet to the microwave regions of the electromagnetic spectrum.

N76-24764# Baird-Atomic, Inc., Bedford, Mass.

OPTIMIZATION AND EVALUATION OF A FLUORESCENCE OIL SPILL DETECTOR. VOLUME 2: PROTOTYPE DESIGN Final Report, Dec. 1974 - May 1975

Herman G. Eldering and William A. Webb. May 1975. 30 p (Contract DOT-CG-43845-A; CG Proj. 7542.4.1) (AD-A016464; USCG-D-109-Vol-2; Rept-5/75-6233-Vol-2) Avail: NTIS CSCL 07/4

This report reviews the operational and technical requirements of a low cost harbor surveillance unit and describes the design of a Scanning Oil Spill Detector. Operational considerations such as coverage resulted in a design containing both azimuth and elevation scanning. The incremental cost of scanning is less than the cost of additional units needed to provide the additional coverage. GRA

N76-24861*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

TRANSFORMATION OF APPARENT OCEAN WAVE SPECTRA OBSERVED FROM AN AIRCRAFT SENSOR PLATFORM

Lamont R. Poole. Washington. Jun. 1976. 23 p refs (NASA-TN-D-8246; L-10802) Avail: NTIS HC \$3.50 CSCL 08C

The problem considered was transformation of a unidirectional apparent ocean wave spectrum observed from an aircraft sensor platform into the true spectrum that would be observed from a stationary platform. Spectral transformation equations were developed in terms of the linear wave dispersion relationship and the wave group speed. An iterative solution to the equations was outlined and used to transform reference theoretical apparent spectra for several assumed values of average water depth. Results show that changing the average water depth leads to a redistribution of energy density among the various frequency bands of the transformed spectrum. This redistribution is most severe when much of the energy density is expected, a priori, to reside at relatively low true frequencies. Author

N76-24871# Naval Research Lab., Washington, D.C. Advanced Space Sensors Applications Branch.

AN INVESTIGATION OF THE REMOTE DETERMINATION OF SEA SURFACE TEMPERATURE USING MICROWAVE RADIOMETRY Interim Report

James P. Hollinger, Robert M. Lerner, and MacMillan M. Wisler. Nov. 1975. 56 p refs (NRL Proj. G01-10; WF52551702) (AD-A018771; NRL-MR-3159) Avail: NTIS CSCL 08/3

This is an interim report on an ongoing program to develop a passive microwave system for the remote all-weather measurement of sea surface temperature from a satellite platform. It presents the results of a theoretical investigation of the interdependence of the relevant environmental and instrumental parameters and their effect on the measured microwave brightness temperature and the sea surface temperature derived from it. The parameters considered are sea surface temperature, sea salinity, ocean roughness (wind speed), atmospheric water vapor, clouds, and the observational frequency. Detailed descriptions of the calculations of the emission and reflection of

the sea surface, the emission and absorption of the atmosphere, the translation and rotation of the antenna properties from the satellite-oriented coordinate system to an earth-oriented system, and the convolution of the antenna reception pattern with the total radiation over the earth's surface are given. Calculations of the microwave brightness temperature and of the uncertainty of the sea surface temperature derived from it for a range of values and uncertainties of the environmental conditions are presented. These calculations indicate that the optimum observational frequency for the determination of sea surface temperature lies between about 3 and 6 GHz. The dominant source of error is due to uncertainty in the effects of ocean roughness. A multifrequency microwave system will be required to correct for the effects of the various environmental factors and to obtain the sea surface temperature to an uncertainty of less than 1 C. GRA

N76-26462# Science Applications, Inc., La Jolla, Calif.

A PORTABLE GAS-FILTER-CORRELATION SPECTROMETER FOR HCl AND HF Final Report, 15 Jan. 1974 - 31 Jan. 1975

E. Roy Bartle. Oct. 1975. 42 p refs (Contract F41609-74-C-0014; AF Proj. 7164) (AD-A020032; SAI-75-525-LJ; SAM-TR-75-33) Avail: NTIS CSCL 14/2

A portable gas-filter-correlation spectrometer (GFCS) has been developed to continuously monitor HCl and HF over the concentration range from 0.2 to 1000 ppm. The unit operates using either 115 VAC 60 Hz or 12 VDC. The attained threshold sensitivities of 167 and 200 ppb for HCl and HF, respectively, are nearly those predicted from theoretical considerations. Excellent specificity is obtained in the presence of anticipated interfering species. The system also can be converted into an active long-path system using a retroreflector; ranges up to 500 m (1-km optical path) can be used with about the same sensitivities. A technique for passive single-ended remote sensing is described that appears to offer significant potential for ranges up to 1 km. This monitor can be used on air pollution detection. GRA

N76-26611 Texas A&M Univ., College Station.

EVALUATION OF LANDSAT MULTISPECTRAL SCANNER DATA FOR MAPPING VEGETATED LANDSCAPES Ph.D. Thesis

David Richard Thompson. 1975. 168 p (Univ. Microfilms Order No. 76-12699)

The LANDSAT multispectral scanner data were selected to represent periods of adequate soil water, soil water deficit, and beginning of soil water recharge in Brazos County, Texas to evaluate LANDSAT multispectral scanner data for mapping vegetated soil landscapes. Six test sites were evaluated using LARSYS computer programs developed by the Laboratory for Application of Remote Sensing, Purdue University. Open grassland soils were best separated at a period when soil moisture was being replenished after a deficit period. Woodland soils were separated by LANDSAT data only when adequate moisture was available in late spring. Separation was not possible during a period of soil water deficit. The 0.6-0.7 micrometers spectral band of LANDSAT was most significant in separating grassland vegetation while the 0.7-0.8 micrometers spectral band was the most significant on wooded vegetation. Dissert. Abstr.

N76-26632* National Aeronautics and Space Administration, Washington, D.C.

REMOTE SENSING AND APPLICATIONS

William Stoney. In its NASA Earth Resources Survey Symp., Vol. 2-A. Jun. 1975. p 7-9

CSCL 05B

A brief review of application of remote sensing technology is given. The effectiveness of the multispectral band scanner, color analysis of imagery, and resolution are among the factors discussed. The users' need for repetitive data, rapid data delivery, and developing digital data techniques are also considered. J.M.S.

N76-26633* National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.

ALL YOU EVER WANTED TO KNOW ABOUT REMOTE SENSING

D. Wayne Mooneyhan *In its* NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 11-28

CSSL 05B

A brief review of remote sensing state-of-the-art is presented. Emphasis is placed on an understanding of remote sensing terminology. Passive and active sensors and sensor platforms from the spacecraft program to the ground truth program are described. J.M.S.

N76-26640* National Aeronautics and Space Administration, Washington, D.C.

FUTURE REMOTE-SENSING PROGRAMS

Russell L. Schweickart *In its* NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 79-82

CSSL 05B

User requirements and methods developed to fulfill them are discussed. Quick-look data, data storage on computer-compatible tape, and an integrated capability for production of images from the whole class of earth-viewing satellites are among the new developments briefly described. The increased capability of LANDSAT-C and Nimbus G and the needs of specialized applications such as, urban land use planning, cartography, accurate measurement of small agricultural fields, thermal mapping and coastal zone management are examined. The affect of the space shuttle on remote sensing technology through increased capability is considered. J.M.S.

N76-26668* Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

REMOTE SENSING, A SKETCH OF THE TECHNOLOGY

David Landgrebe *In* NASA, Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 367-370

CSSL 05B

Information is provided on how a potential user of remote sensing technology can gain access to all of the products and services he will need to get started. It was envisioned that these include data, training, hardware, and software. A very brief tutorial summary of the fundamentals of the technology is presented. Author

N76-26762*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF THE NIMBUS 5 ESMR TO RAINFALL DETECTION OVER LAND SURFACES Final Report, Nov. 1974 - Nov. 1975

Jack M. Meneely Nov. 1975 53 p refs

(Contract NAS5-20878)

(NASA-CR-144764; ES-1008) Avail: NTIS HC \$4.50 CSSL 04B

The ability of the Nimbus 5 Electrically Scanning Microwave Radiometer (ESMR) to detect rainfall over land surfaces was evaluated. The ESMR brightness temperatures (Tb sub B) were compared with rainfall reports from climatological stations for a limited number of rain events over portions of the U.S. The greatly varying emissivity of land surfaces precludes detection of actively raining areas. Theoretical calculations using a ten-layer atmospheric model showed this to be an expected result. Detection of rain which had fallen was deemed feasible over certain types of land surfaces by comparing the Tb sub B fields before and after the rain fell. This procedure is reliable only over relatively smooth terrain having a substantial fraction of bare soil, such as exists in major agricultural regions during the dormant or early growing seasons. Soil moisture budgets were computed at selected sites to show how the observed emissivity responded to changes in the moisture content of the upper soil zone. Author

N76-27646*# Arizona Univ., Tucson. Office of Arid Land Studies.

APPLIED REMOTE SENSING PROGRAM (ARSP) Annual Report

Jack D. Johnson, Kenneth E. Foster, David A. Mouat, David A. Miller, and Jeffery S. Conn Jun. 1976 66 p refs

(Grant NGL-03-002-313)

(NASA-CR-148324; OALS-Bull-13) Avail: NTIS HC \$4.50 CSSL 08F

The activities and accomplishments of the Applied Remote Sensing Program during FY 1975-1976 are reported. The principal objective of the Applied Remote Sensing Program continues to be designed projects having specific decision-making impacts as a principal goal. These projects are carried out in cooperation and collaboration with local, state and federal agencies whose responsibilities lie with planning, zoning and environmental monitoring and/or assessment in the application of remote sensing techniques. The end result of the projects is the use by the involved agencies of remote sensing techniques in problem solving. Author

N76-28003# Particle Measuring Systems, Boulder, Colo.
THE RESPONSE OF OPTICAL ARRAY SPECTROMETERS TO ICE AND SNOW, A STUDY OF PROBE SIZE TO CRYSTAL MASS RELATIONSHIPS Report for 14 Feb. - 15 Aug. 1975

Robert G. Knollenberg 8 Sep. 1975 80 p refs

(Contract F19628-75-C-0141; AF Proj. 627A)

(AD-A020276; AFCRL-TR-75-0494; SR-1) Avail: NTIS CSSL 20/6

This report is a summary of work performed by Particle Measuring Systems, Inc., to study the response of optical array spectrometers to ice and snow crystals. The principle objective of this study was to perform laboratory, field and theoretical studies to establish more appropriate optical array probe particle size-to-mass relationships. The studies involved both 1-D and 2-D optical array spectrometers. The following report briefly describes the work performed and the results. The sections are not necessarily organized in the chronology that they were performed. While it was intended that the theoretical work might be performed prior to field studies it was necessary to modify theoretical models based upon field observations. In many cases, phases of this work proceeded essentially in parallel with considerable readjustment upon integrating all phases of work. GRA

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GENERAL

09

Includes economic analysis.

A76-31464 # Report on the Finnish earth-resources remote-sensing program (Bericht über das finnische Erderkundungsprogramm). E. Kilpelä and R. Kuittinen (Finnisches Technisches Forschungszentrum, Laboratorium für Bodennutzung, Otaniemi, Finland). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 547-552. In German.

The aim of the Finnish earth resources program is the semi-automatic classification of remote sensor data for land use and conservation inventory and environmental monitoring in Finland. Remote sensor investigations are divided into three basic areas: forest monitoring, with emphasis on mapping and classification, geological surveys, with mapping techniques used for rock identification and prospecting and water resources surveys, with particular attention paid to turbidity, flow characteristics, temperature and overall quality of surface water. The remote sensing imagery is to be primarily digital and to be gathered from aircraft and satellites (Landsat). B.J.

A76-31470 # Satellite base data as a starting point for an economical remote sensing program (Satelliten-Basisdaten /SBD/ als Ausgang für ein ökonomisches Erderkundungsprogramm). H. Kaminski (Bochum, Sternwarte, Bochum, West Germany). In: Symposium on Earth Survey, Porz-Wahn, West Germany, April 7-11, 1975, Reports. Cologne, Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, 1975, p. 637-651. 21 refs. In German.

It is suggested to catalog the meteorological and environmental VHR (Very High Resolution Radiometer) data obtained (starting with 1963) in the European and neighboring geographic regions, and to make them available to scientists engaged in studying the parameters of the earth surface, the atmosphere, and hydrosphere by remote sensing techniques. The advantages which would accrue from the availability of cataloged data are pointed out. V.P.

A76-31476 Technology for the new horizon; Proceedings of the Thirteenth Space Congress, Cocoa Beach, Fla., April 7-9, 1976. Cocoa Beach, Fla., Canaveral Council of Technical Societies, 1976. 313 p. \$21.25.

The congress was devoted to the following topics: Spacelab program and payloads, marine sciences and remote sensing, Space Shuttle technical problems, international aeronautics, solar energy conversion, the role of man in space flight operations and communication satellite programs. Papers are presented on the application of radar scattering to ocean wave research and the study of ocean internal waves using satellite imagery and ship data. Technical challenges of integrating the Space Shuttle are studied together with lightning problems likely to be encountered by the Shuttle and the problems of autoignition, ice and frost accumulation, dewatering, noise suppression and payload processing in relation to Shuttle development. Hydrogen production using solar energy, the photo-electrolysis of water by solar energy and the use of satellites to determine optimum locations for solar power stations are all discussed. Also considered are the development and utilization of the Telesat, the Marisat and the Symphonie systems. B.J.

A76-31973 High altitude applications of the Gates Learjet. R. D. Neal (Gates Learjet Corp., Denver, Colo.). Society of Automotive Engineers, Business Aircraft Meeting, Wichita, Kan., Apr. 6-9, 1976, Paper 760-491. 11 p. 8 refs.

Two existing applications at altitudes of 50,000 feet of the Gates Learjet are described. In one application, the airplane was equipped (for space exploration purposes) with a 12-inch diameter infrared telescope. The second application is the installation of single- and dual-camera pods for use in aerial mapping missions. The single-camera pod configuration could be converted to the original configuration, whereas the dual-camera pod configuration was a permanent modification (due to the necessity of structural changes in the basic fuselage pressure vessel). The development of a high altitude research vehicle (HARV) from the original Learjet configuration is described which resulted in an airplane that should be capable of providing smooth flight at 60,000 feet. V.P.

A76-32301 International Symposium on Space Technology and Science, 11th, Tokyo, Japan, June 30-July 4, 1975, Proceedings. Symposium sponsored by the Akashi-Seisakusho, Ltd., Anritsu Electric Co., National Space Development Agency of Japan, et al. Edited by T. Takenouchi. Tokyo, AGNE Publishing, Inc., 1975. 1051 p. \$90.

The papers deal with theoretical and experimental studies in space technology and science areas of current interest. The areas covered are: propellants and propulsion systems; flight dynamics and aerodynamics; the space environment; spacecraft, booster, and space transportation systems; electronic devices and components; space communications, telemetry, and tracking; guidance and control; systems engineering; space science and space investigations; observation balloons; space medicine and space biology; remote sensing of the earth and earth resources; and the Space Shuttle and Skylab projects. V.P.

A76-32414 Earth resources satellite design to improve data, quality and timeliness. J. E. Taber (TRW Systems, Redondo Beach, Calif.). In: International Symposium on Space Technology and Science, 11th, Tokyo, Japan, June 30-July 4, 1975, Proceedings. Tokyo, AGNE Publishing, Inc., 1975, p. 831-836.

Data collected by Landsat is proving a useful tool in the evaluation of resource phenomena in a variety of disciplines. Extension of this observation technique to a system yielding higher quality and more timely data poses some interesting system tradeoffs. Geometric quality and geodetic control of collected images are influenced by sensor design, orbit stability, attitude control, and ground processing techniques. Understanding these relationships can lead to realistic subsystem performance requirements which minimize development and operating costs while maximizing information content of the collected data. Similarly, understanding the data routing requirements from point of collection to ultimate user, and such routing techniques, as on-board processing, direct-to-user transmission, data relay from satellites, data recording, and ground data processing can lead to high-data-volume systems which can minimize the lag between data collection and dissemination. This paper discusses these relationships and the system design consequences of emphasizing certain requirements over others. (Author)

A76-32426 * An overview of NASA's remote sensing program. P. G. Thome (NASA, Washington, D.C.). In: International Symposium on Space Technology and Science, 11th, Tokyo, Japan, June 30-July 4, 1975, Proceedings. Tokyo, AGNE Publishing, Inc., 1975, p. 915-921.

The present status of NASA's remote sensing program and its future plans are reviewed, and some investigations into the possible uses of remotely sensed data are briefly summarized. Landsat-1 photographs are presented to demonstrate how such data can be

employed for monitoring and forecasting of agricultural production, for watershed management and flood control, and for mineral exploration. The performance of Landsat-2 and expectations for Landsat-C are evaluated. High-priority problems which should be the driving forces for designing space observation systems for the 1980's are outlined, including the problem of world food supply and the relationship between land use and climatic changes. The design of the modular Landsat-D spacecraft, which will fly a thematic mapper for agricultural observations, is described. F.G.M.

A76-33187 # Economic analysis of Ontario farms from aerial photographs. R. A. Ryerson (Department of Energy, Mines, and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: Symposium on Remote Sensing and Photo Interpretation, Banff, Alberta, Canada, October 7-11, 1974, Proceedings. Volume 1. Ottawa, Canadian Institute of Surveying, 1975, p. 125-135. 7 refs.

A76-35004 * # Seasat-A - A product of user interests. S. W. McCandless, Jr. (NASA, Office of Applications, Washington, D.C.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 39-44. 8 refs.

The paper describes how user requirements were integrated into the development of the Seasat-A program and shows how user requirements influenced sensor selection, mission planning, satellite systems design, and the end-to-end data system. User requirements included the measurement of ocean topography, surface winds, gravity waves, surface temperature, sea ice, salinity, and surface pressure. Particular attention is paid to the selection of sensors: compressed pulse radar altimeter, synthetic aperture imaging radar, microwave wind scatterometer, visible/infrared radiometer, and multispectral microwave radiometer. B.J.

A76-35014 # The synchronous meteorological satellite /SMS/ - Its advantages and applications. R. A. Scofield and V. J. Oliver (NOAA, National Environmental Satellite Service, Washington, D.C.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 159-162.

The advantages of SMS are 24-hr reception of 8 km resolution infrared cloud pictures at half-hour intervals and high resolution (1 km) visual pictures every half hour during daytime. Several examples of SMS visual and IR imagery are presented and discussed. They include visible and IR images of thunderstorm clusters in a large Atlantic frontal system, visible imagery of haze, pollution, and thunderstorms over the U.S. east coast, visible imagery of Hurricane Fifi, visible imagery of thunderstorm clusters, and an arc cloud and infrared imagery of cloud tops. B.J.

A76-35032 # The application of remote sensing data to geographic-based information management systems. J. A. Halpern, L. D. Alexander, and D. M. O'Regan (Dames and Moore, Cranford, N.J.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 351-358.

A76-35050 # The first approach to realizing a German earth research program. M. Wahl and A. Flasche (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Arbeitsgruppe Allgemeine Raumfahrtprojekte, Cologne, West Germany). In: International Symposium on Remote Sensing of Environment, 10th, Ann

Arbor, Mich., October 6-10, 1975, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 523-532.

The main goal of a German earth research program is to assure qualified participation of the FRG in future worldwide earth observation systems. At the time being, the main national efforts concentrate on preparing and carrying out two complementary programs: The earth research airborne measurement program with the main activities in developing hard- and software systems for data preprocessing and data analysis and interpretation. Within the Spacelab utilization program, specific sensor systems suitable for earth observation and meteorology are in the initial phase of development. (Author)

A76-35077 # Improved resource use decisions and actions through remote sensing. M. Boylan, W. R. Enslin, R. Hill-Rowley, and R. D. Vlasin (Michigan State University, East Lansing, Mich.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 793-802.

The experience of the Michigan State University Remote Sensing Research Program in assisting public agencies and private organizations in improving management decisions and actions in the field of earth resources is illustrated by eight case studies from the period 1974-1975. These include: (1) land value appraisal in Charlevoix County, Michigan; (2) optimization of agri-business processing plant location; (3) implementation of a comprehensive county plan (Antrim County, Michigan) to locate, map and remove and salvage junk vehicles; (4) identification of rural water supply sites available to fire-fighting units; (5) timber inventory, management, and utilization in Mason County, Michigan; (6) general land cover and special environments inventory and analysis in Grand Traverse County, Michigan; (7) land cover inventory for the Kalamazoo watershed; and (8) land use inventory of the southeast Michigan region. B.J.

A76-35079 # Worldwide disaster warning and assessment with Earth Resources Technology Satellites. C. J. Robinove (U.S. Geological Survey, Reston, Va.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 811-820. 28 refs.

Images of the earth collected by ERTS-1 and later experimental and operational satellites can be used for the warning and assessment of disasters throughout the world. Floods, fire, glacier movement, and drought are the disasters most amenable to satellite sensing and analysis. Other disasters to which applications are promising but not yet completely feasible are earthquakes, volcanic eruptions, crop failures, and water pollution. Practical application of satellite images to disaster assessment requires the continued and reliable operation of satellites and data reception stations, rapid distribution of data to interpretive teams and to affected countries, and the rapid analysis and dissemination of maps and other results. (Author)

A76-35086 # International approaches to remote sensing. R. Chipman (United Nations, Outer Space Affairs Div., New York, N.Y.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 901-905.

The United Nations, through its Committee on the Peaceful Uses of Outer Space and the Outer Space Affairs Division of the Secretariat, has been involved for many years in promoting international cooperation in applications of space technology in general

and remote sensing in particular. The UN has established the Space Applications Program to promote the transfer of this technology to developing countries, and the United Nations Development Program, the World Bank, and the Food and Agriculture Organization are incorporating remote sensing technology into their development projects. The programs are based mainly on the Landsat system for which three countries now have ground systems, two more are under construction and one is in the design stage. Two regional agencies, the Economic and Social Commission for Asia and the Pacific, have recently started planning for regional remote sensing centers. Additional ground stations can be expected and other countries will be launching remote sensing satellites. This growing international effort must be coordinated, and the training programs will be required to ensure that all countries benefit. (Author)

A76-35109 * # An analysis of the accuracy and cost-effectiveness of a cropland inventory utilizing remote sensing techniques. J. R. Jensen, L. R. Tinney, and J. E. Estes (California, University, Santa Barbara, Calif.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1149-1158. NASA-supported research.

Cropland inventories utilizing high altitude and Landsat imagery were conducted in Kern County, California. It was found that in terms of the overall mean relative and absolute inventory accuracies, a Landsat multitime analysis yielded the most optimum results, i.e., 98% accuracy. The 1:125,000 CIR high altitude inventory is a serious alternative which can be very accurate (97% or more) if imagery is available for a specific study area. The operational remote sensing cropland inventories documented in this study are considered cost-effective. When compared to conventional survey costs of \$62-66 per 10,000 acres, the Landsat and high-altitude inventories required only 3-5% of this amount, i.e., \$1.97-2.98. (Author)

A76-35120 * # A cost-effectiveness comparison of existing and Landsat-aided snow water content estimation systems. J. M. Sharp and R. W. Thomas (California, University, Berkeley, Calif.). In: International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Mich., October 6-10, 1975, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1975, p. 1255-1262. 17 refs. Grant No. NGL-05-003-404.

This study describes how Landsat imagery can be cost-effectively employed to augment an operational hydrologic model. Attention is directed toward the estimation of snow water content, a major predictor variable in the volumetric runoff forecasting model presently used by the California Department of Water Resources. A stratified double sampling scheme is supplemented with qualitative and quantitative analyses of existing operations to develop a comparison between the existing and satellite-aided approaches to snow water content estimation. Results show a decided advantage for the Landsat-aided approach. (Author)

A76-35711 Space activity impact on science and technology. Edited by L. G. Napolitano (Napoli, Università, Naples, Italy), P. Contensou, and W. F. Hilton. Oxford, Pergamon Press, Ltd., 1976. 412 p. In English and French. \$50.

The papers deal with the influence of space research on scientific, technological, industrial, and social development. Topics include progress in automation and control theory associated with automatic vehicles for lunar exploration, industrial uses of aerospace technology, the development of liquid-propellant rocket engines, general problems in aerospace medicine, the role of space research in the development of celestial mechanics, and the impact of space activity on the science of rotational dynamics. Other papers discuss Skylab systems flight performance, the design and utilization of a spacelab for sortie missions, remote sensing from manned spacecraft,

geologic applications of remote sensing from space, satellite ranging techniques, the MAROTS program, and spacecraft habitability. Atmosphere revitalization for manned spacecraft is examined along with the development of a technology base for planetary-entry aerothermodynamics, analysis of nonlinear unstable motions in solid-propellant engines, the Copernicus satellite, the Delta Model 2914 launch vehicle, space-tug mission and program planning, and the influence of space activity on education.

F.G.M.

A76-35724 The new satellite GOES A (Le nouveau satellite GOES A). R. Lasbleiz (Météorologie Nationale, Centre de Météorologie Spatiale, Lannion, Côtes-du-Nord, France). *La Météorologie*, Mar. 1976, p. 131-133. In French.

The principal characteristics of GOES A, a geostationary meteorological satellite launched by NASA for NOAA (National Oceanic and Atmospheric Administration) on Oct. 16, 1975, are reviewed. The satellite will conduct quasi-continual observations of the terrestrial cloud cover, provide real-time detection of solar eruptions, and transmit WEFAX (Weather Facsimile Experiment) information by means of a specialized channel. The satellite, weighing 300 kg after ejection of the apogee motor, will take its permanent position at 75 deg 5 min W in January 1976, at which time it will function in place of the prototype SMS 1, which will be held in reserve. The Visible and Infrared Spin Scan Camera, consisting of 8 visible and one infrared sensor, will scan the region subtended by an angle of 18 deg and transmit data in four modes at a carrying frequency of 1691 GHz. C.K.D.

A76-36675 * # Seasat-A - An ocean observation satellite. F. L. Williams and S. W. McCandless, Jr. (NASA, Special Programs Office of Applications, Washington, D.C.). *COSPAR; Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper*. 10 p.

Mission details, onboard equipment, and measurements to be taken are described for the Seasat-A global ocean monitoring satellite. The satellite is designed for mapping the global ocean geoid, charting ice fields and leads, precision measurement of sea surface topography, global monitoring of wave height and wave directional spectra, surface winds and wind direction, current patterns, and ocean temperature. Data handling subsystems, a compressed pulse radar altimeter, coherent synthetic aperture imaging radar, microwave wind scatterometer, scanning visible/IR radiometer, scanning multispectral (5 freq) microwave radiometer mounted on the satellite are described briefly. R.D.V.

A76-38102 Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, Proceedings. Symposium sponsored by the Canadian Remote Sensing Society. Edited by G. E. Thompson (Department of Energy, Mines and Resources, Public Relations and Information Services, Ottawa, Canada). Ottawa, Canadian Aeronautics and Space Institute, 1976. 498 p. \$40.

All-weather remote sensing (RS), real-time transmission of remotely-sensed (RS) data, methods of enhancement of RS data, image processing, classification and error definition, spectral signatures of vegetation, timber and forest stands, and landforms, integration of RS methods and interpretation (aerial color IR photography, side-looking and down-looking radar, Landsat-1) are discussed. Many of the contributions feature multicolor false-color illustrations. Coastal hydrology, wetlands mapping, resources management, land use mapping, surveys of ice and snow cover, lake algae, and oil spills are among the topics covered, in addition to: the use of RS in monitoring pest damage to crops, crop productivity, and monitoring of bird nesting and migration. Some articles deal with RS surveys of particular regions.

R.D.V.

A76-38103 # Remote sensing - The future. W. M. Strome (Canada Centre for Remote Sensing, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, *Proceedings*. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 7-25. 14 refs.

The history of remote sensing is summarized and prospects for future remote sensing systems, both experimental and operational, are examined. Brief sketches are provided of the Landsat, heat capacity mapping mission, Seasat, Nimbus, Earth Observation Satellite (Landsat-D), ITOS, ARTISS, the Canadian ocean monitoring satellite, Spacelab, the Space Shuttle project, tracking and data relay satellite system (TDRSS) programs. Airborne, RPV-borne, and balloon-borne remote sensing systems are also mentioned. Data processing, analysis of remotely sensed data, computer analysis of observational data, the multispectral analyzer display (MAD) system and operational utilization of remotely sensed data, particularly in ice reconnaissance, are also covered. R.D.V.

A76-38140 # Remote sensing and economic value of errors in wheat forecasting. D. J. Clough (Waterloo, University, Waterloo, Canada). In: Canadian Symposium on Remote Sensing, 3rd, Edmonton, Alberta, Canada, September 22-24, 1975, *Proceedings*. Ottawa, Canadian Aeronautics and Space Institute, 1976, p. 457-488. 15 refs.

The discussed report has the objective to provide quantitative estimates of the potential Canadian benefits of improved forecasting concerning the supply and demand of export wheat. Attention is given to the specification of an empirical relationship between the price of Canadian export wheat and variables such as demand, production, and stock carryovers. A specification of measures of economic benefits related to changes of price and quantity exported is considered. An investigation is conducted regarding the specification of models to describe the impact of errors in forecasts of wheat export demands and quantities available, on prices, quantities exported, and benefits. G.R.

N76-22625*# Dudley Observatory. Albany, N.Y.
S-149 MICROMETEORITE COLLECTION EXPERIMENT Final Report
Curtis L. Hemenway. Principal Investigator [1975] 50 p refs EREP
(Contract NAS9-10380)
(E76-10306; NASA-CR-147548) Avail: NTIS HC \$4.00 CSCL 03B

N76-22640*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
LEGAL ASPECTS OF SATELLITE ESTIMATION, CONSERVATION AND DEVELOPMENT OF EARTH RESOURCES
Giovanni Meloni Washington NASA Apr. 1976 14 p refs
Transl. into ENGLISH from the book "Colloquium on the Law of Outer Space, 15th, Vienna, Austria, October 8-15, 1972, *Proceedings*" Hackensack, N. J., Fred B. Rothman and Co., 1973 p 38-44
(Contract NASw-2789)
(NASA-TT-F-16991) Avail: NTIS HC \$3.50 CSCL 05D

The harmonization of the national interest of individual nations with the common interest of mankind as a whole in the utilization of space for such peaceful purposes as the survey, conservation, and development of earth resources is discussed. Special attention is given to the possibilities and limitations of international control of such space activities by United Nations organs. Author

N76-22653# Georgia Univ., Athens. Environmental Resources Center.
A SIMULATION APPROACH TO THE ANALYSIS OF UNCERTAINTY IN PUBLIC WATER RESOURCES PROJECTS
Technical Completion Report
Bernard W. Taylor, III and Ronald M. North Sep. 1975 86 p refs

(Contract DI-14-31-0001-4010)
(PB-247114/2; ERC-1375; W76-01510; OWRT-A-052-GA(1))
Avail: NTIS HC \$5.00 CSCL 13B

The existing economic criteria for evaluating water resource projects are deterministic and therefore incomplete since these criteria do not include any consideration of uncertainty of possible outcomes. A Monte Carlo simulation approach was used to generate values for a mean and a standard deviation for the benefits, costs, benefit-cost ratios and net present values for the Spewrell Bluff Project in Georgia to demonstrate the variability of probable outcomes from investing public funds in the project. A triangular distribution of most likely, most optimistic, and most pessimistic estimates of project managers within the Corps of Engineers formed the basis for the simulation. GRA

N76-22655# Utah Water Research Lab., Logan.
REGIONAL DEVELOPMENT: AN ECONOMETRIC STUDY OF THE ROLE OF WATER DEVELOPMENT IN EFFECTUATING POPULATION AND INCOME CHANGES
Herbert H. Fullerton, W. Cris Lewis, Jay C. Andersen, John E. Keith, and Reed Willis Jun. 1975 59 p refs
(Contract DI-14-31-0001-4131)
(PB-248711/4; PRRBE089-1; W76-03137; OWRT-B-080-UTAH(1)) Avail: NTIS HC \$4.50 CSCL 13B

Twelve measures of regional economic growth, including population and three measures of income were compared for areas with and without water investment in 246 counties and 42 water resource subareas in the states of Utah, Colorado, New Mexico, Montana, Wyoming, Idaho, and Nevada. For some areas where more detailed records of water investment were available, a nine equation econometric model was estimated using three-stage least squares analysis. It was found that total gross output attributable to projects ranged from zero in the petroleum and mining sectors to a high of 260,302 in the dairy industry. Other findings are also discussed. GRA

N76-22699# National Bureau of Economic Research, Inc., Washington, D.C.
CONFERENCE ON ECONOMETRICS AND MATHEMATICAL ECONOMICS. WORKSHOP ON ENERGY-RELATED GENERAL RESEARCH IN MICRO-ECONOMICS
Robert Solow (MIT), Joseph Stiglitz (Stanford Univ.), and Gary Fromm May 1975 72 p refs Presented at the Conf. on Nat. Resources, Palo Alto, Calif., 9-11 May 1975
(Grant NSF SOC-74-20175)
(PB-247466/6) Avail: NTIS HC \$4.50 CSCL 05C

The principles of microeconomics theory were applied to the discovery, extraction, and utilization of natural resources. Sixteen papers are summarized in the workshop report. These papers fall into four general categories: optimal extraction of natural resources; market structure and intertemporal allocation; special problems of exploration and leasing; and the economics of renewable resources. Conference participants also identified an agenda of research in these areas that remained to be done. GRA

N76-23343 Denver Univ., Colo.
A METHOD OF OPTIMIZING THE REPORTING MODE OF CONSTRAINED REMOTE TELEMETRY SYSTEMS
Ph.D. Thesis
Thomas Layne Livingston 1975 134 p
Avail. Univ. Microfilms Order No. 76-10291

Generalized expressions for modeling a telemetry system are formulated, and the critical parameters in the representations are asserted and defined. Expressions are developed for determining communications performance, reporting performance, and reporting efficiency as a function of the mode of reporting the data. Markov representations of the interrogated and dual reporting process provide a convenient means for determining the expected number of interrogations required to successfully accomplish a data report. The transmission format incorporated in the theoretical model permits maximum flexibility in adapting it to a variety of systems. As a result of the generalized format, the relative effects of different encoding schemes upon the

communications performance can be analyzed. The optimization method's utility and adaptability for practical applications is demonstrated for an ocean buoy system that telemeters environmental data via the synchronous GOES satellite.

Dissert. Abstr.

N76-23650*# Nebraska Univ., Lincoln.

APPLICATIONS OF REMOTE SENSING IN RESOURCE MANAGEMENT IN NEBRASKA Semiannual Progress Report, Jul. - Dec. 1975

James V. Drew and Marvin P. Carlson, Principal Investigators
Dec. 1975 22 p ERTS

(Grant NGL-28-004-020)

(E76-10323; NASA-CR-147203) Avail: NTIS HC \$3.50 CSCL 05A

N76-23664*# Ambionics, Inc., Washington, D.C.

SURVEY AND ANALYSIS OF POTENTIAL USERS OF REMOTE SENSING DATA Final Report

12 Nov. 1975 222 p refs

(Contract NASw-2756)

(NASA-CR-147927) Avail: NTIS HC \$7.75 CSCL 05B

Remote sensing applications for the activities of the regional interstate organizations, the federal agencies, and the private sector are examined. The survey covered activities in all 50 states. Emphasis has been placed on on-going operational programs and no attempt was made to cover the activities of the federal agencies except insofar as they impinged on State or other regional or metropolitan programs. Author

N76-23673*# Technicolor Graphics, Inc., Sioux Falls, S. Dak.

AUTHOR INDEX TO PUBLISHED ERTS-1 REPORTS

Timothy C. Bidwell and Cheryl A. Mitchell 15 Oct. 1975 88 p
Sponsored in part by NASA

(Contract DI-14-8-001-14790)

(NASA-CR-147341; PB-248294/1; USGS-LI-75-018) Avail: NTIS HC \$5.00 CSCL 05B

This index has been compiled to assist the reader in locating and obtaining reports on the 334 scientific experiments conducted under the National Aeronautics and Space Administration (NASA) Earth Resources Technology Satellite-1 (ERTS-1) (renamed LANDSAT) program. It lists the reports that have been published between April 1972 and September 1975. Each of the documents can be purchased from the National Technical Information Service (NTIS). GRA

N76-23734# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

PERSPECTIVES IN ENERGY REQUIREMENTS OF MANKIND

J. L. Symonds Aug. 1975 34 p refs

(AAEC/IP-2) Avail: ERDA Depository Libraries HC \$4.75

The growth of energy demand from the nineteenth century to the present and its likely future development are described, for the interested layman, in the context of the changing pattern of resource use. The availability and distribution of the renewable and nonrenewable resources of energy, which will provide for the future, show that developed and developing countries will incur supply problems in the decades ahead unless the potential of all energy reserves is tapped. Factors such as the market penetration of new resources and the depletion of resources are outlined. It is pointed out that coal may be used increasingly for some time, but nuclear energy is the only other energy form that is immediately available and that can be utilized commercially. Nuclear energy will be needed even if countries are prepared to cut back to low growth rates in energy use. It is suggested that lower growth rates may well be necessary in the next twenty to thirty years, since it takes this time to bring new alternative technologies into commercial use, and a further similar period will be required to achieve significant resource substitution. Author (ERA)

N76-24653*+ New Mexico Univ., Albuquerque.

REMOTE SENSING OF NATURAL RESOURCES: QUARTERLY LITERATURE REVIEW First Quarter, 1976

[1976] 222 p Sponsored by NASA

(NASA-CR-147151) Copyright. Avail: NTIS for foreign requesters only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque CSCL 08F

A quarterly review of technical literature concerning remote sensing techniques is presented. The format contains indexed and abstracted materials with emphasis on data gathering techniques performed or obtained remotely from space, aircraft, or ground-based stations. Remote sensor applications including the remote sensing of natural resources are presented. A.S.K.

N76-24657*# Ohio Dept. of Economic and Community Development, Columbus.

DEVELOPMENT OF A MULTI-DISCIPLINARY ERTS USER PROGRAM IN THE STATE OF OHIO Progress Report

Paul E. Baldridge, Principal Investigator 10 Mar. 1976 4 p ref ERTS

(Contract NAS5-22399)

(E76-10334; NASA-CR-147218; PR-3) Avail: NTIS HC \$3.50 CSCL 05B

N76-25601# Committee on Science and Technology (U. S. House).

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION: OVERSIGHT HEARINGS

Washington GPO 1976 491 p refs Hearings before Subcomm. on the Environment and the Atmosphere of Comm. on Sci. and Technol., 94th Congr., 1st Sess., 16-18, 22-25 Jul. 1975 (GPO-62-587) Avail: Subcomm. on the Environment and the Atmosphere

Testimony concerning the operations of the National Oceanic and Atmospheric Administration is presented. Witnesses delivered reports concerning a variety of meteorological and oceanographic research programs. Topics include: the World Weather Program, data buoys, National Weather Service, meteorological satellites, the Sea-Grant Program and environmental research. A.S.K.

N76-26618*# Arizona Univ., Tucson. School of Renewable Natural Resources.

USE OF EARTH RESOURCES TECHNOLOGICAL SATELLITE (ERTS) DATA IN A NATURAL RESOURCE INVENTORY Final Report, Aug. 1972 - Sep. 1974

Edwin L. Smith, Phil R. Ogden, and Ernest B. Fish, Principal Investigators Jul. 1975 101 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21820)

(E76-10388; NASA-CR-148168) Avail: NTIS HC \$5.50 CSCL 05B

N76-26631*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

NASA EARTH RESOURCES SURVEY SYMPOSIUM, VOLUME 2-A: SPECIAL SESSION PRESENTATIONS. PLENARY SUMMARIES

Jun. 1975 163 p refs Symp. held at Houston, Texas, 9-12 Jun. 1975 Original contains color illustrations

(NASA-TM-X-58168-Vol-2A; JSC-09930-Vol-2A) Avail: NTIS HC \$3.50 CSCL 05B

Practical application of earth resources survey data is considered. The utilization and results of data from NASA programs involving LANDSAT, the Skylab Earth Resources Experiment Package, and aircraft, as well as other data acquisition programs are included. User services and requirements and applications in land use, agriculture, coastal zone management, and geology are among the topics covered

09 GENERAL

N76-26634* Department of Health, Education, and Welfare, Washington, D.C.

APPLICATIONS OF EARTH RESOURCES TECHNOLOGY TO HUMAN NEEDS

Caspar Weinberger /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 29-32
CSCL 05K

The application of remote sensing technology in the fields of health and education is examined. The technology and accomplishments of ATS 6 and the development of a nationwide telecommunications system to meet the varied needs of the health and education communities are among the topics discussed. The economic and social aspects of utilizing and benefiting from remote sensing technology are stressed. J.M.S.

N76-26635* Geological Survey, Washington, D.C.
DEPARTMENT OF THE INTERIOR PROGRAM

James R. Balsley /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 33-36
CSCL 05A

The remote sensing activities of the Department of Interior are summarized. The use of satellite imagery in land and water management is described. Specific topics discussed include: land use mapping, exploration and discovery of metal, oil, and gas deposits, location of geological faults, and repetitive monitoring of dynamic environmental phenomena related to water resources. J.M.S.

N76-26636* Corps of Engineers, Washington, D.C.
US ARMY CORPS OF ENGINEERS PROGRAM

John Jarman and K. E. McIntyre /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 37-41
CSCL 05B

The application of satellite remote sensing technology in hydrologic studies and regulatory programs of the U.S. Army Corps of Engineers is discussed. Site selection, location of construction material, environment impact assessment, analysis of hydrologic systems, reservoir system analysis, water quality, quantity and quality of runoff from urban areas, river hydraulics, and sediment movement are among the applications described. Emphasis is placed on introducing automatic classification of multispectral data into modeling techniques used in hydrologic studies. J.M.S.

N76-26643* Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

INFORMATION/USER SERVICES, SUMMARY

David Landgrebe /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 123-127
CSCL 05B

Various aspects of the technology which are available to users now are described. Specific topics discussed include: data distribution; availability of and access to data; technology transfer; system use illustrations and availability of training; hardware systems descriptions; processing hardware constructed and available; data processing techniques; individual processing techniques; and future developments: a sampling of future technology. Author

N76-26646*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

NASA EARTH RESOURCES SURVEY SYMPOSIUM. VOLUME 2-B: SPECIAL SESSION PRESENTATIONS. COASTAL ZONE MANAGEMENT, STATE AND LOCAL USERS, USER SERVICES

Jun. 1975 222 p refs Symp. held at Houston, 9-12 Jun. 1975. Original contains color illustrations (NASA-TM-X-58168-Vol-2B; JSC-09930-Vol-2B) Avail: NTIS HC \$3.50 CSCL 05B

Applications of remote sensing technology to environmental problems and resources management are presented.

N76-26648* National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

INFORMATION NEEDS: PERCEIVED AND REAL FOR STATE DECISIONMAKERS

A. R. Schwartz (Tex. State Senate), Chris Spirou (New Hampshire House of Representatives), William Kier (Senate Off. of Res.), and Michele Tetley (NOAA) /In its NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 176-187

CSCL 05B

Remote sensing techniques provide important information for land and water use planning organizations in order to assess coastal developments and their impact on water resources, sediment transport, erosion, and marine biology. Political expediency requires pertinent data acquisition and data dissemination to local populations for coastal zone management decision making. G.G.

N76-26659* Governor's Office of Information Services, Austin, Tex.

REMOTE-SENSING APPLICATIONS FOR TEXAS

John Wells /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 297-299

CSCL 05B

The earth resources remote sensing activity of Texas and its applications are reported. A combination of digital, photographic, and traditional methods is being used to manage the water impoundments inventory, a land use survey, a wildlife habitat survey, and a coastal zone survey. G.G.

N76-26661* Joint Federal-State Land Use Planning Commission for Alaska, Juneau.

ALASKA'S NEEDS IN REMOTE SENSING

John L. Hall /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 315-318
CSCL 05B

Joint Federal/State remote data sensing centers are advocated to help survey Alaska for land use planning by aerial photography and LANDSAT imagery. The centers are to provide satellite derived information in land use planning and offshore oil developments. G.G.

N76-26662* Tennessee Valley Authority, Norris.

USER REQUIREMENTS FOR PROJECT-ORIENTED REMOTE SENSING

H. C. Hitchcock, F. P. Baxter, and T. L. Cox (Remote Sensing Inst.) /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 319-325 refs

CSCL 05B

Registration of remotely sensed data to geodetic coordinates provides for overlay analysis of land use data. For aerial photographs of a large area, differences in scales, dates, and film types are reconciled, and multispectral scanner data are machine registered at the time of acquisition. G.G.

N76-26663* Louisiana Office of State Planning, Baton Rouge.
LOUISIANA COMPREHENSIVE PLANNING INFORMATION SYSTEM

Patrick W. Ryan and Ed. Schwertz /In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 326-339
CSCL 05B

A statewide computerized land use mapping system is reported that uses polygons to identify inventories from aerial photography by employing the USGS classification system. In addition, the system provides soil, population, and housing census

data as well as economic indicators that can be useful in relating to the overall system. G.G.

N76-26664* Minnesota State Planning Agency, St. Paul.
REMOTE SENSING IN MINNESOTA: EVALUATION OF PROGRAMS AND CURRENT NEEDS
J. E. Sizer. In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 340-350

CSCL 05B

Aerial photographs of the entire state were used to develop information on geomorphic regions, land ownership, forest cover, soils, geology, land classification and land capability. LANDSAT imagery was included to update many photomaps for land use classification and urban development planning. G.G.

N76-26665* Ohio Dept. of Economic and Community Development, Columbus.
REMOTE SENSING IN THE STATE OF OHIO. 1. PUBLIC POLICY. 2. SYSTEM DEVELOPMENT
Paul Goessling and Frank Leone. In NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 351-355
CSCL 05B

Different types of satellite and conventional remote sensing data are used to monitor urban growth and the pattern of development. Software programs were developed for a growth allocation model that uses LANDSAT information as the basic component. G.G.

N76-26670* Auburn Univ., Ala. Industrial Engineering and Mechanical Engineering Dept.
DEVELOPMENT OF ALABAMA RESOURCES INFORMATION SYSTEM, ARIS Annual Report, 1 Jul. 1974 - 1 May 1976
B. E. Herring and R. I. Vachon 1 May 1976 83 p
(Contract NAS8-30654)
(NASA-CR-144342; ALA-AU-X996-1060-5) Avail: NTIS HC \$5.00 CSCL 08F

The design and implementation of a working, user-oriented set of computer procedures which permit the storage, retrieval, and manipulation of geographic and demographic data are described. Author

N76-26671* National Aeronautics and Space Administration, Washington, D.C.
INPUTS REQUESTED FROM EARTH RESOURCES REMOTE SENSING DATA USERS REGARDING LANDSAT-C MISSION REQUIREMENTS AND DATA NEEDS
1976 27 p refs
(NASA-TM-X-73007; NASA-AN-OA-76-B) Avail: NTIS HC \$4.00 CSCL 08B

Inputs from prospective LANDSAT-C data users are requested to aid NASA in defining LANDSAT-C mission and data requirements and in making decisions regarding the scheduling of satellite operations and ground data processing operations. Design specifications, multispectral band scanner performance characteristics, satellite schedule operations, and types of available data products are briefly described. J.M.S.

N76-26674* Battelle Columbus Labs., Ohio.
SURVEY OF USERS OF EARTH RESOURCES REMOTE SENSING DATA Final Report
G. E. Wukelic, J. G. Stephan, H. E. Smail, L. Landis, and T. F. Ebbert 31 Mar. 1976 154 p refs
(Contract NASw-2800)
(NASA-CR-147361) Avail: NTIS HC \$6.75 CSCL 08A

A user survey was conducted to determine current earth resources survey (ERS) data use/user status and recommendations for strengthening use. Only high-altitude aircraft and satellite

(primarily LANDSAT) data were included. Emphasis was placed on the private sector/industrial user. Objectives of the survey included: who is using ERS data, how they are using the data, the relative value of current data use as well as obtaining user views as to possible ways of strengthening future ERS data use. The survey results are documented and should provide relevant decision making information for developing future programs of maximum benefit to all end users of satellite ERS data. Author

N76-27621* Department of Scientific and Industrial Research, Wellington (New Zealand).

DEVELOPMENT OF REMOTE SENSING TECHNOLOGY IN NEW ZEALAND, PART 1. MAPPING LAND USE AND ENVIRONMENTAL STUDIES IN NEW ZEALAND, PART 2. INDIGENOUS FOREST ASSESSMENT, PART 3. SEISMO-TECTONIC, STRUCTURAL, VOLCANOLOGIC AND GEOMORPHIC STUDY OF NEW ZEALAND, PART 4 Quarterly Report

Mervyn C. Probyn, Richard P. Suggate, Ian F. Stirling, and Michael G. McGreevy, Principal Investigators Jun. 1976 69 p refs
Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (E76-10389; NASA-CR-148203; Rept-531; QR-2) Avail: NTIS HC \$4.50 CSCL 05B

The author has identified the following significant results. As part of the tape reformatting process, a simple coded picture output program was developed. This represents Pixel's radiance level by one of a 47 character set on a nonoverprinting line printer. It not only has aided in locating areas for the reformatting process, but has also formed the foundation for a supervised clustering package. This in turn has led to a simplistic but effective thematic mapping package.

N76-27624* National Research Council, Bangkok (Thailand).
THAILAND NATIONAL PROGRAMME OF THE EARTH RESOURCES TECHNOLOGY SATELLITE Progress Report
Sanga Sabhasri, Principal Investigator May 1976 8 p Sponsored by NASA ERTS (E76-10404; NASA-CR-148217; G-28080) Avail: NTIS HC \$3.50 CSCL 05B

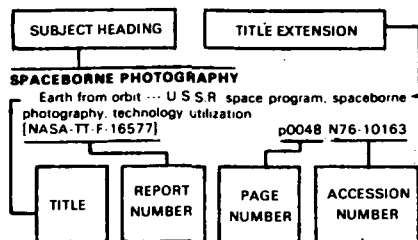
The author has identified the following significant results. The study on locating hill tribe villages from LANDSAT imagery was successful and exceeded the initial expectations. Results of the study on land use and forest mapping using Skylab data demonstrated the capability and feasibility of large scale mapping with high accuracy.

N76-27716* Committee on Science and Technology (U. S. House).
ENVIRONMENTAL R AND D POSTURE HEARINGS
Washington GPO 1975 990 p refs Hearing before Subcomm. on the Environment and the Atmosphere of Comm. on Sci. and Technol., 94th Congr., 1st Sess., No. 21, 22-24, 29-30 Apr. and 1 May 1975 (GPO-57-591) Avail: Subcomm. on the Environment and the Atmosphere

Testimony regarding governmental activities in numerous areas of environmental research and development is presented. Topics covered include air and water pollution, environment protection, agriculture, meteorology, oceanography and earth resources management. D.M.L.

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Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of the document content, the title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section (of this supplement). If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

A

ABSORPTION SPECTRA

- The correlation interferometer - A new instrument specifically designed for remote measurement of atmospheric trace species p0263 A76-35025
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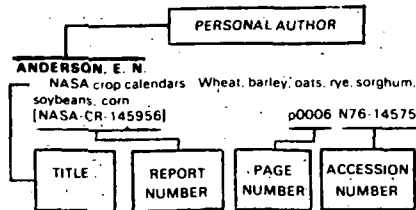
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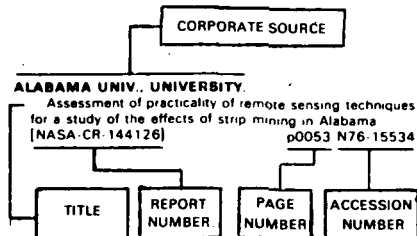
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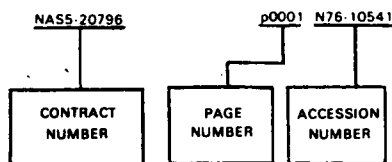
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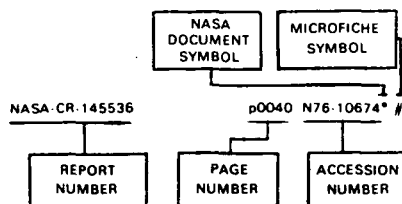
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